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SELECTED WATER RESOURCES ABSTRACTS

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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 21, NUMBER 4
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W88-02493 -- W88-03492



The Secretary of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 30, 1988.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Water Resources Scientific Information Center. The cumulative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey
MS 425 National Center
Reston, VA 22092

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TESTS OF ARMA MODEL FORMS FOR RAINFALL-RUNOFF MODELLING,
Queensland Water Resources Commission, Brisbane (Australia).
W. D. Weeks, and W. C. Boughton.
Journal of Hydrology JHYDA7, Vol. 91, No. 1/2, p 29-47, May 15, 1987. 1 fig, 17 tab, 28 ref.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, *Model studies, *Data interpretation, *ARMA models, *Rainfall, *Runoff, Mathematical equations, Model testing, Hydrologic aspects, Australia.

Mathematical rainfall-runoff models of the Auto-Regressive Moving Average (ARMA) type are used in many different hydrologic analyses. While the general form of this type of model is well accepted, there are some questions on model form identification, parameter estimation, and the effects of different time increments. Some of these aspects were examined with reference to recorded hydrologic data for a catchment of 375 sq km in eastern Australia. A selected modelling procedure was presented that can represent the relationship between rainfall and runoff in a simple and effective way. (Author's abstract)
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APPLICATION OF DISCRETE AUTOREGRESSIVE MOVING AVERAGE MODELS FOR ESTIMATION OF DAILY RUNOFF,
Ohio Univ., Athens. Dept. of Civil Engineering.
T. J. Chang, J. W. Delleur, and M. L. Kavvas.
Journal of Hydrology JHYDA7, Vol. 91, No. 1/2, p 119-135, May 15, 1987. 5 fig, 2 tab, 23 ref, append. USDI Grant OWRT-B-112-IND.

Descriptors: *Rainfall-runoff relationships, *Runoff, *Runoff forecasting, *DARMA models, *Discrete autoregressive moving average models, *Model studies, *Data interpretation, *Estimating, Precipitation, Transfer function, Statistical methods, Indiana, Transfer model, Rainfall, Stream discharge.

Daily precipitation was successfully modeled by the Discrete Autoregressive Moving Average (DARMA) family of models. One of these models is used in the estimation of daily streamflows by means of a linear transfer function. The statistical properties of the chosen DARMA precipitation process and the first- and second-order statistics of the relationship between daily precipitation and the corresponding streamflow are used in the determination of the transfer function parameters. The constructed process is applied to a watershed located in Indiana. The model identification, the parameter estimation, and the diagnostic checking are illustrates. This transfer model has the merit that it couples the first- and second-order statistics of the rainfall input and runoff output. The model limitations stem from the stationarity of the DARMA models used for the description for the daily rainfall sequences. This requires the division of the year into stationary seasons and introduces minor inaccuracies at the season crossings. (Author's abstract)
W88-02771

DEVELOPMENT AND TESTING OF A WATER BALANCE MODEL FOR CLIMATE IMPACT ASSESSMENT: MODELING THE SACRAMENTO BASIN,
California Univ., Berkeley. Energy and Resources Group.
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DROUGHT, RAIN, AND MOVEMENT OF A RECURRENT EARTHFLOW COMPLEX IN NEW ZEALAND,
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W88-02838

COMPUTATION OF INFLOWS AND OUTFLOWS OF EIGHT REGULATED LAKES IN THE OSWEGO RIVER BASIN, NEW YORK, 1930-79,
Geological Survey, Ithaca, NY. Water Resources Div.
R. Lumia, and R. B. Moore.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 82-4112, 1983. 51 p, 6 fig, 9 tab.

Descriptors: *Hydrologic budget, *Water budget, *Finger Lakes, *New York, Lake levels, Data collection, Streamflow.

Estimates of daily inflows and outflows of eight regulated lakes in the Oswego River basin and discharges of three rivers draining these lakes were computed and compiled for use in evaluated lake-regulation procedures in the basin's stream and reservoir system and are stored on computer. This report includes a table of monthly flows at these sites from 1930-79. Computations were based on records from the 1930-79 water years. Daily net inflow estimates (lake inflow minus evaporation and possible groundwater seepage) were computed from the outflows and changes in lake storage. Lake storage was estimated from lake level data and elevation-capacity curves for each lake. A smoothing technique was applied to plots of daily lake levels before net inflows were computed. Where lake level or outflow data were missing, net flows were estimated from linear regression equations. Analysis of results indicates that: (1) smooth-

ing the plots of daily lake levels significantly reduces random fluctuations resulting from seiche or wind action; (2) continuous lake storage recorders provide a more reliable record than staff gages (once-daily, lake level readings) for computing daily changes in lake storage; and (3) the effect of smoothing decreases as the computational period is increased. (USGS)
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EVALUATION OF SIX METHODS FOR ESTIMATING MAGNITUDE AND FREQUENCY OF PEAK DISCHARGES ON URBAN STREAMS IN NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
D. A. Stedfast.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4350, 1986. 24 p, 4 fig, 5 tab, 27 ref.

Descriptors: *Urban hydrology, *Urban runoff, *Flood frequency, *Rainfall-runoff relationships, *New York, Model studies, HEC-1 model, Basin characteristics, Error analysis.

Six methods of estimating peak discharges of urban streams were compared and evaluated for applicability to urban streams in New York. Discharge and frequency values developed from a series of synthesized annual flood records were compared with values obtained from the six methods. The synthesized flood records were computed from rainfall-runoff models of 11 urban basins in three counties across the State. Four of these basins had a sufficient period of record to enable rainfall-runoff modeling of two different 5-year periods so that increases in peak flow due to increased urbanization could also be used for comparison of the six methods. A graphical analysis and three types of mathematical analyses were made to evaluate the closeness of fit and bias of the methods. All methods showed a tendency to overestimate synthetic urban flood-magnitude values, but the two adjust rural flood-frequency estimates on a nationwide basis showed smallest standard errors of estimate and bias. The standard errors for these two methods ranged from 44 to 57 percent over the six recurrence intervals (2, 5, 10, 25, 50, and 100 year), and the bias ranged from +28 to +53 percent. The bias, however, is probably due to errors inherent in using synthetic records and in applying the New York rural flood-frequency equations to urban basins with small drainage areas. (USGS)
W88-03036

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Geological Survey, Ithaca, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
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RUNOFF CHARACTERISTICS AND WASHOFF LOADS FROM RAINFALL-SIMULATION EXPERIMENTS ON A STREET SURFACE AND A NATIVE PASTURE IN THE DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
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1983 DROUGHT IN THE WESTERN PACIFIC,
Geological Survey, Honolulu, HI. Water Resources Div.
O. Van der Brug.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Supply Paper 85-418, 1986. 89 p, 28 fig, 23 tab, 49 ref.

Descriptors: *Droughts, *Rainfall data, *Hydrologic data, *Hawaii, Agricultural losses, Pacific Islands, Western Pacific.

At the end of 1982 and during the first half of 1983, the weather in much of the world was unusual. In the Pacific, El Nino, a phenomenon that occurs when the lack of trade winds allows warm Western Pacific waters to flow to the west coast of the Americas, was the worst in 100 years. This phenomenon is thought to be the cause of severe drought in the Western Pacific. Half of the monthly rainfall totals recorded during January to May 1983 at long-term rainfall stations in the Western Pacific, were the lowest on record. Total rainfall in the Western Pacific for this six-month period was 27-29 percent of normal west of 155 degrees E longitude and 12-13 percent of normal east of this longitude. The recurrence interval for the drought in the Caroline and Marshall Islands was estimated at 125 years for Koror (Palau Islands), Yap Island, Moen (Truk Islands), and Majuro (Marshall Islands), and 250 years for Ponape and Kosrae. Average monthly streamflow for most streams in the Caroline Islands was the lowest on record each month from January to May 1983. On Ponape and Kosrae, the streamflow for the first five months of 1983 was 3-7 percent of normal, on Moen (Truk Islands) 8 percent. The average chloride concentration of groundwater on Moen, the main source of water for the island, increased from 78 to 410 milligrams per liter between February 10 and April 20, 1983. On Saipan, the yield of springs decreased by 80 percent and the chloride concentration of groundwater from most wells exceeded 1,000 milligrams per liter. Water conservation measures were taken on all islands ranging from voluntary conservation on Guam to a water rationing of one hour every third day on Majuro and one gallon per day per person on Jaluit atoll (Marshall Islands). Agricultural losses of taro, coconut, and breadfruit (the staple food of most islands) were severe; especially on Ponape, Kosrae, and in the Marshall Islands. At least half the population of the Caroline and Marshall Islands were receiving U.S. Department of Agriculture food supplements. No cost estimates for the drought losses have been made. (USGS)
W88-03103

ESTIMATING STREAM-AQUIFER INTERACTIONS IN COAL AREAS OF EASTERN KANSAS USING STREAMFLOW RECORDS,
Geological Survey, Lawrence, KS. Water Resources Div.
H. E. Bevans.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. Supt Doc, USGPO, Wash, DC 20402. In: USGS Water-Supply Paper 2290, 1986. p 51-64, 8 fig, 1 tab, 9 ref.

Descriptors: *Surface-groundwater relations, *Aquifer characteristics, *Kansas, Recession curves, Base flow, Correlation analysis, Regression analysis, Groundwater storage, Groundwater recharge, Evapotranspiration, Pennsylvanian coal.

Stream-aquifer interactions for drainage basins in coal areas of eastern Kansas were estimated from streamflow records and are presented as an alternative or supplement to digital modeling. Streams draining coal-mined parts of this area usually are contaminated during low flow by groundwater containing large concentrations of sulfate discharged from the mines. The capacity of a stream to assimilate the coal-mine drainage is governed by the availability of base flow for dilution. Although digital models simulating interactions between streams and aquifers are available, representative values of aquifer properties necessary to calibrate the models commonly are unavailable and are expensive to obtain. Values of the stream-aquifer property T/a sq S (where T is the transmissivity of the aquifer, a is the average distance from the stream to the groundwater divide, and S is the storage coefficient of the aquifer) ranging from 0.012 to 0.049 per day were determined from the slopes of base-flow regression curves recorded at 18 selected streamflow-gaging stations. Correlation and regression analysis was used to develop an equation for predicting the stream-aquifer property for ungaged streams in the study area. The correlation coefficient for this relationship is -0.99, and the standard error of estimate is 0.001 per day. Examples of procedures for estimating groundwater storage, recharge, discharge, and evapotranspiration by means of streamflow records are presented. (USGS)
W88-03116

RECENT GROWTH OF GULKANA GLACIER, ALASKA RANGE, AND ITS RELATION TO GLACIER-FED RIVER RUNOFF,
Geological Survey, Fairbanks, AK. Water Resources Div.
For primary bibliographic entry see Field 2C.
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COASTAL-A DISTRIBUTED HYDROLOGIC SIMULATION MODEL FOR LOWER COASTAL PLAIN WATERSHEDS IN GEORGIA,
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For primary bibliographic entry see Field 4A.
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ANALYSIS AND GENERATION OF LOW FLOW SEQUENCES FOR IDAHO STREAMS USING DISAGGREGATION MODELING,
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W88-03189

MODEL STUDY OF THE EFFECT OF TEMPORAL STORM DISTRIBUTIONS ON PEAK DISCHARGES AND VOLUMES,
University of the Witwatersrand, Johannesburg (South Africa). Water Systems Research Programme.
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W88-03279

STRUCTURE OF A SEMI-DISTRIBUTED ADAPTIVE MODEL FOR FLOOD FORECASTING,
Consiglio Nazionale delle Ricerche, Perugia (Italy). Ist. di Ricerca per la Protezione Idrogeologica nell' Italia Centrale.
For primary bibliographic entry see Field 2E.
W88-03280

SIMULATED FLOOD DISCHARGES AND ELEVATIONS FOR THE SAVANNAH RIVER, SOUTH CAROLINA AND GEORGIA, USING AN UNSTEADY STREAMFLOW MODEL,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03443

EFFECTS OF OCTOBER 1981 FLOOD ON THE QUANTITY AND QUALITY OF WATER IN SELECTED STREAMS AND RESERVOIRS IN THE BRAZOS RIVER BASIN, TEXAS,

F. C. Wells, T. L. Schertz, and M. W. Flugrath.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4055, 1984. 119 p, 28 fig, 4 ref.

Descriptors: *Excess rainfall, *Water quality, *Rainfall-runoff relationships, *Texas, *Brazos River basin, Water temperature, Lakes, Reservoirs, Hubbard Creek Reservoir, Possum Kingdom Lake, Lake Granbury, Lake Whitney.

The storm that moved across north-central Texas during October 11-13, 1981, produced intense rainfall along a line extending from east of Abilene, Texas to Breckenridge, Texas to north of Mineral Wells, Texas. Rainfall in excess of 20 inches was recorded near Clyde, Texas and in several locations near Breckenridge. Results of water quality surveys conducted before and after the storm, including temperature data, dissolved oxygen data, and specific conductance, dissolved solids, dissolved chloride, dissolved sulfate and hardness were analyzed for Hubbard Creek Reservoir, Possum Kingdom Lake, Lake Grandbury, and Lake Whitney. A record peak discharge of 96,600 cu ft/sec was recorded at the gaging station Brazos River near Dennis, Texas on October 14. The discharge-weighted average concentration of dissolved solids decreased from 1,630 mg/L on October 6, to 103 mg/L on October 13. The monthly discharge-weighted average concentration of dissolved solids for October 1981 was 782 mg/L and the monthly dissolved solids load was 1,143,000 tons. The peak discharge recorded at the gaging station Brazos River near Glen Rose, Texas was 86,400 cu ft/sec on October 15. Water flowing past this gaging station flowed into Lake Whitney causing the water level to rise 18.85 ft and the storage contents to increase from 538,000 to 1,050,000 acre-ft during 10 days. The net change in storage contents of 512,000 acre-ft is nearly equal to 1/2 the 1,098,000 acre-ft recorded at the Brazos river near Glen Rose for the month of October. The large volume of runoff associated with the floods on the upper Brazos River basin had a pronounced effect on the quality of water in Hubbard Creek Reservoir, Possum Kingdom Lake, Lake Granbury, and Lake Whitney. The volume-weighted average concentrations of dissolved solids decreased by more than 50% between the August and October water quality surveys on Hubbard Creek Reservoir, Possum Kingdom Lake, and Lake Granbury. The volume-weighted average concentrations of dissolved solids decreased from 570 to 281 mg/L in Hubbard Creek Reservoir, from 1,560 to 665 mg/L in Possum Kingdom Lake and from 1,520 to 750 mg/L in Lake Granbury. Similar decreases were noted in the volume-weighted average concentrations of dissolved chloride, sulfate, and hardness in each of the reservoirs. The decrease in volume-weighted-average concentrations can be attributed directly to the inflow of relatively dilute floodwaters into each of the reservoirs. (USGS)
W88-03446

PRELIMINARY ASSESSMENT OF CLIMATIC CHANGE DURING LATE WISCONSIN TIME, SOUTHERN GREAT BASIN AND VICINITY, ARIZONA, CALIFORNIA, AND NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2B.
W88-03453

2B. Precipitation

ORGANOCHLORINE INSECTICIDE RESIDUES IN THE RAIN WATER IN DELHI, INDIA,
Delhi Univ. (India). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W88-02494

SOURCE OF PB, CU, AND ZN IN FOGWATER,
California State Univ.-Stanislaus, Turlock. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W88-02497

REAL-TIME RAINFALL DATA ACQUISITION SYSTEM,
Royal Observatory (Hong Kong).
For primary bibliographic entry see Field 7B.
W88-02622

SHORT TERM SNOWMELT FLOW FORECAST SYSTEM,
H. Pena, and B. Nazarala.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 155-161, 4 fig.

Descriptors: *Snowmelt, *Forecasting, *Data acquisition, *Chile, *Computer models *Hydrologic data collections, Runoff, Seasonal variation, Precipitation, Satellite technology, Flow profiles, Model studies.

The river regime in the central part of Chile is greatly affected by the accumulation of snow and ice in the Andes Cordillera during the winter months (April-September) and its subsequent melting during the spring-summer period. The heavier-than-normal precipitation of 1982 made it advisable during the months of snowmelt to set up a river flow telemetering and flood forecasting system. For this purpose, data collection platforms based on the GOES satellite were installed at river gauging stations. Because weather forecasts are not available more than 24 hours in advance, the forecast gave the maximum discharge to be expected for the three following days assuming the most favorable conditions for snowmelt. THus the range of possible variations in future flows was obtained. Flows were obtained through the use of a very simplified hydrological simulation model. This model subdivided the catchment area into areas of equal elevation and considered as input data the flow of the day prior to the forecast, maximum daily temperature at a point in the catchment are and the snow line. In addition, an adjustment algorithm was incorporated into the model to take account of the previous day's results. This particularly simple forecasting procedure was successfully used during the 1982/83 snowmelt season. The simulation model was developed in APL language and programmed into a 64 K microcomputer. (W88-02617) (Author's abstract)
W88-02630

ACID RAIN SOURCEBOOK.
For primary bibliographic entry see Field 5G.
W88-02650

CANADIAN ACID RAIN PROGRAM,
Ontario Ministry of the Environment, Rexdale.
For primary bibliographic entry see Field 5G.
W88-02656

SCIENTIFIC ISSUES ASSOCIATED WITH ACID RAIN,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
For primary bibliographic entry see Field 5C.
W88-02658

DETERMINATION OF ALKALI AND ALKALINE EARTH IONS IN RAIN WATER BY ION CHROMATOGRAPHY (BESTIMMUNG VON ALKALI- UND ERDALKALIIONEN IN REGENWASSERPROBEN MIT DER IONENCHROMATOGRAPHIE),
Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Anorganische Chemie und Kernchemie.
For primary bibliographic entry see Field 5A.
W88-02671

ARRIVAL RATE OF RAINDROPS AT THE GROUND,
Auckland Univ. (New Zealand).
J. G. Hosking, and C. D. Stow.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 26, No. 4, p 433-442, April 1987. 6 fig, 14 ref.

Descriptors: *Rainfall intensity, *Rainfall, *Rain, *Statistical analysis, *Clustering, Air masses.

Examination of the arrival-rate distribution of raindrops from disturbed, post-cold-front air masses using the statistic k, the ratio of the variance of the drop rate to the mean, shows strong deviation from Poisson behavior toward clustering of drops. Clustering occurs predominantly for drops smaller than about 0.25 mm radius and correlates strongly with the small-drop arrival rate and, to a lesser extent, with rainfall intensity but does not appear to be caused by drop splashing, breakup or local turbulence. There is evidence to suggest that, if rapid intensity fluctuations are causing clustering, these fluctuations occur with a characteristic period of less than 10 s. (Author's abstract)
W88-02680

ATTEMPT TO NORMALIZE THE HAILSTORM VARIABILITY FOR THE EVALUATION OF CLOUD SEEDING,
Research Council of Alberta, Edmonton. Atmospheric Sciences Dept.
For primary bibliographic entry see Field 3B.
W88-02681

NIGHT-TIME N2O5/NO3 CHEMISTRY AND NITRATE IN DEW WATER,
Ford Motor Co., Dearborn, MI. Research Staff.
For primary bibliographic entry see Field 5B.
W88-02682

RAIN CHEMISTRY AT A MIDCONTINENT SITE, U.S.A., 1980-1984,
Arkansas Univ., Fayetteville. Dept. of Geology.
G. H. Wagner, and K. F. Steele.
Atmospheric Environment ATENBP, Vol. 21, No. 6, p 1353-1362, June 1987. 4 fig, 6 tab, 32 ref. Agricultural Experiment Station of Arkansas Project NC-141 and Project IR-7.

Descriptors: *Rain chemistry, *Water chemistry, *Rainfall, *Ions, Minerals, Carbonates, Aerosols.

Normal rains at Fayetteville, corrected for sea-salt contributions, are characterized by the following stoichiometries: (NH4(+) + H(+) = SO4(2-) and (Ca(2+) + Mg(2+) + K(+) + Na(+)) = NO3(-) where the ionic symbols represent equivalents. Small variations to these equalities are caused by sequestering of NH4NO3 and/or HNO3, and mineral carbonate aerosols. Excessive amounts of the latter cause anomalous rains which are outside these stoichiometries. The three main aerosols responsible for normal rain compositions at Fayetteville are: 1.37 (NH4)2SO4.H2SO4 (52%), Ca(NO3)2 (28%) and NaCl(6.3%). The NaCl is from sea-salt and the Ca(NO3)2 from the reaction of HNO3 and limestone aerosols. (Alexander-PTT)
W88-02683

SUPERSATURATION OF CARBONYL SULFIDE (OCS) IN RAIN WATERS,
Centre des Faibles Radioactives, Gif-sur-Yvette (France).
For primary bibliographic entry see Field 2K.
W88-02684

VARIATION OF WET DEPOSITION CHEMISTRY IN SEQUOIA NATIONAL PARK, CALIFORNIA,
Sequoia and Kings Canyon National Parks, Three Rivers, CA.
For primary bibliographic entry see Field 5B.
W88-02685

INTERACTION BETWEEN A NATURAL SNOWFALL AND A COOLING TOWER PLUME: AN EXPERIMENTAL STUDY WITH A MILLIMETRIC DOPPLER RADAR,
Clermont-Ferrand-2 Univ., Lannemezan (France).

Center of Atmospheric Research.
For primary bibliographic entry see Field 6G.
W88-02686

TREATING UNCERTAINTY IN MODELS OF THE ATMOSPHERIC CHEMISTRY OF NITROGEN COMPOUNDS,
UKAEA Atomic Energy Research Establishment, Harwell (England). Modelling and Assessments Group.
For primary bibliographic entry see Field 2K.
W88-02687

DEPOSITION OF RADIONUCLIDES FROM CHERNOBYL TO A FOREST IN BELGIUM,
Louvain Univ. (Belgium).
For primary bibliographic entry see Field 5B.
W88-02688

VARIATIONS IN DIFFERENT SIZED WATER INSOLUBLE PARTICULATE MATTER IN RAIN WATER,
National Inst. for Environmental Studies, Tsukuba (Japan).
Y. Ambe, and M. Nishikawa.
Atmospheric Environment ATENBP, Vol. 21, No. 6, p 1469-1471, June 1987. 2 fig, 1 tab, 8 ref.

Descriptors: *Particulate matter, *Rainfall, *Rain, *Temporal variation, Particle size, Distribution, Rainfall intensity.

Temporal variations in different sized water insoluble particles in rain water during five rainfall events were investigated in a suburban area. The mass of particles ranged: 45-88% (particle size > 8 micron), 12-43% (1-8 micron) and 0-13%(0.4-1 micron). A high concentration and following sharp decrease of the particles larger than 8 micron were observed at the initial stage of rainfall; the rate of the decrease was higher in the heavier rain. In many cases, the mass concentration of particles in rain water showed an inverse correlation with rainfall intensity. The variation of the smaller size particles was less significant compared to the larger ones. (Author's abstract)
W88-02689

PESTICIDES IN RAINWATER IN THE NORTHEASTERN UNITED STATES,
Heidelberg Coll., Tiffin, OH. Water Quality Lab.
For primary bibliographic entry see Field 5B.
W88-02790

ENSO SIGNAL IN CONTINENTAL TEMPERATURE AND PRECIPITATION RECORDS,
Massachusetts Univ., Amherst.
R. S. Bradley, H. F. Diaz, G. N. Kiladis, and J. K. Eischeid.
Nature NATUAS, Vol. 327, No. 6122, p 497-501, Jun 11, 1987. 5 fig, 32 ref.

Descriptors: *ENSO events, *El Nino, *Precipitation, *Air temperature, *Weather data collections, *Northern hemisphere, *Temperature effects, Southern Oscillation, Temperature, Pacific Ocean, Air circulation.

Warm events in the tropical Pacific Ocean, associated with one extreme of the Southern Oscillation (generally known as El Nino - Southern Oscillation or ENSO events) are now known to be of global significance in perturbing the general circulation of the atmosphere. It is also apparent that episodes of enhanced cold-water upwelling ('cold events') have an impact on large-scale atmospheric circulation patterns. The effects of warm and cold events on short-term fluctuations of continental surface air temperature and precipitation throughout the Northern Hemisphere were examined using a newly compiled set of high-quality temperature and precipitation data. The data were in the form of gridded anomalies from a 1951-70 reference mean for temperature and a 1921-60 reference mean for precipitation. (Author's abstract)
W88-02791

COMPARATIVE ABILITIES OF LEAF SURFACES TO NEUTRALIZE ACIDIC RAINDROPS: I. THE INFLUENCE OF CALCIUM NUTRITION AND CHARCOAL-FILTERED AIR,
Toronto Univ. (Ontario). Dept. of Botany.
For primary bibliographic entry see Field 2I.
W88-02794

DETERMINATION OF ALKALI AND ALKALINE EARTH IONS IN RAIN WATER BY ION CHROMATOGRAPHY (BESTIMMUNG VON ALKALI- UND ERDALKALIIONEN IN REGENWASSERPROBEN MIT DER IONENCHROMATOGRAPHIE),
Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Anorganische Chemie und Kernchemie.
For primary bibliographic entry see Field 5A.
W88-02816

RELATION BETWEEN MEASURED RADAR REFLECTIVITY AND SURFACE RAINFALL,
For primary bibliographic entry see Field 7B.
W88-02839

PRECIPITATION FLUCTUATIONS OVER NORTHERN HEMISPHERE LAND AREAS SINCE THE MID-19TH CENTURY,
Massachusetts Univ., Amherst. Dept. of Geology and Geography.
R. S. Bradley, H. F. Diaz, J. K. Eischeid, P. D. Jones, and P. M. Kelly.
Science SCIEAS, Vol. 237, No. 4811, p 171-175, July 1987. 7 fig, 26 ref.

Descriptors: *Weather data collections, *Model studies, *Rainfall, Rainfall patterns, Weather, Storms, Precipitation, Carbon dioxide, Climate.

An extensive array of measurements extending back to the mid-19th century was used to investigate large-scale changes in precipitation over Northern Hemisphere land areas. Significant increases in mid-latitude precipitation and concurrent decreases in low-latitude precipitation have occurred over the last 30 to 40 years. Although these large-scale trends are consistent with general circulation model projections of precipitation changes associated with doubled concentrations of atmospheric carbon dioxide, they should be viewed as defining large-scale natural climatic variability. Additional work to refine regional variations and address potential network inhomogeneities is needed. This study attempts to show secular precipitation fluctuations over hemispheric- and continental-scale areas of the Northern Hemisphere. (Author's abstract)
W88-02840

ELECTROMETRIC DETERMINATION OF THE PH OF ATMOSPHERIC PRECIPITATION,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
For primary bibliographic entry see Field 5A.
W88-02854

ANALYSIS OF WIND AND PRECIPITATION DATA FOR ASSESSMENTS OF TRANSBOUNDARY TRANSPORT AND ACID DEPOSITION BETWEEN CANADA AND THE UNITED STATES,
Illinois Univ. at Urbana-Champaign.
For primary bibliographic entry see Field 5B.
W88-02908

SATELLITE SUPPORT TO THE SIERRA COOPERATIVE PILOT PROJECT: 1979/80 AND 1980/81,
Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
For primary bibliographic entry see Field 7B.
W88-02943

SURVEY OF POTENTIAL FLOOD PRODUCING RAINFALL IN NATAL,
Natal Univ., Pietermaritzburg (South Africa).
R. E. Schulze.
University of Natal Agricultural Catchments Research Unit Report No 7, Part 1 - Field Studies, Data Processing, Techniques and Models for Applied Hydrological Research - Vol 1, p 365-424, 1979. 19 fig, 2 tab, 14 ref.

Descriptors: *Rainfall rate, *Rainfall intensity, *Flood forecasting, Catchment areas, Data acquisition, Rain gayges, Networks, Mapping, Probability distribution, Systems analysis, Least Squares method, Linear programming, Flood recurrence interval, Spatial distribution, Systems analysis, South Africa, NATAL.

Chapter 16 of Section D: Hydrological Studies of Soil Loss, surveys potential flood producing rainfall in Natal analyzing data from 256 rainstations in and immediately adjacent to Natal. A probalistic approach was used but presented from a spatial point of view. Maps were produced depicting the distribution of sustained heavy rains, the probable maximum rainfalls at selected return periods, the occurrence of annual extreme rainfalls by season as well as ratios and associations of longer duration to one-day annual extreme events. (USGS)
W88-03107

AVAILABILITY OF SELECTED METEROLOGICAL DATA IN COMPUTER-BASED FILES OF THE U.S. GEOLOGICAL SURVEY, MONTANA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING,
Geological Survey, Helena, MT. Water Resources Div.
B. L. Groskinsky-Link, and L. E. Cary.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-693, 1986. 36 p, 5 fig, 14 tab, 24 ref.

Descriptors: *Meteorological data collection, *Weather data collections, Air temperature, Atmospheric pressure, Relative humidity, Solar radiation, Wind velocity, Precipitation, Rainfall, Evaporation, Total evaporation, Montana, North Dakota, South Dakota, Wyoming.

Meteorological data were located, acquired, and stored from selected stations in Montana and North Dakota coal regions and adjacent areas including South Dakota and Wyoming. Data that were acquired have potential use in small watershed modeling studies. Emphasis was placed on acquiring data that was collected during the period 1970 to the present (1984). A map shows the location and type of stations selected. A narration summarizing conventions used in acquiring and storing the meteorological data is provided along with the various retrieval options available. Individual station descriptions are followed by tables listing the meteorological variables collected, period of obtained record, percentage of data recovery, and the instruments used and their description. (USGS)
W88-03139

SIMULATION OF ATMOSPHERIC ACID DEPOSITION ON A REGIONAL SCALE,
Institute for Atmospheric Physics, Budapest (Hungary).
K. E. Fekete, and D. S. Szepesi.
Journal of Environmental Management JEVMAW, Vol. 24, No. 1, p 17-28, January 1987. 4 fig, 4 tab, 11 ref.

Descriptors: *Simulation, *Acid rain, *Regional analysis, *Air pollution, Path of pollutants, Fate of pollutants, Model studies, Simulation analysis, Rainfall, Chemistry of precipitation, Sulfur compounds, Nitrogen compounds, Oxides, Wind, Atmospheric physics, Sulfates, Nitrates, Sulfur dioxide, Particulate matter, Precipitation.

A regional scale operational model is described for the simulation of air and precipitation quality. The aim is to determine quantitatively the complex effects of the following: source strength of sulfur

and nitrogen oxides, effective source height, wind pattern in the transport layer, mixed layer height, precipitation, transformation, wet and dry deposition, and hemispheric background values of air and precipitation quality. The model presents a regional scale territorial distribution of sulfur dioxide, nitrogen dioxide, particulate sulfate and nitrate, nitric acid gas, and precipitation sulfate and nitrate. The total deposition is also expressed as maximal atmospheric acid stress. This first-generation model estimates annual average concentrations and depositions, and is validated by five years of data from the Regional Background Pollution Station in Hungary. (Author's abstract)
W88-03212

MODEL STUDY OF THE EFFECT OF TEMPORAL STORM DISTRIBUTIONS ON PEAK DISCHARGES AND VOLUMES,
University of the Witwatersrand, Johannesburg (South Africa). Water Systems Research Programme.
J. J. Lambourne, and D. Stephenson.
Hydrological Sciences Journal HSJODN, Vol. 32, No. 2, p 215-226, June 1987. 4 fig, 4 tab, 11 ref.

Descriptors: *Storm runoff, *Runoff volume, *Runoff, *Model studies, *Depth-area-duration analysis, *Rainfall-runoff relationships, *Hydrograph analysis, *Runoff forecasting, *Hyetographs, Hydrologic models, Storm water, Mathematical equations, Mathematical studies, Flood peak, Model testing, Catchment areas, Storms, Hydrographs.

A series of synthetic five-year return period storms having rectangular, triangular and bimodal (triangular) temporal profiles was compiled from depth-duration-frequency (D-D-F) relationships based on (a) standard sorted clock time depths and (b) complete storms only. These were used as inputs to a catchment runoff model to simulate the peaks and volumes of runoff from an actual and a hypothetical catchment respectively. The hypothetical catchment was used to prove the adequacy of the simplified hyetographs and the real catchment to demonstrate the difference in runoff hydrographs for the various hyetographs. The results were compared to establish the effect of storm profiles on peak and volume of runoff as well as to indicate the shortcomings of D-D-F relationships derived by conventional methods. In general, on the assumption that the model correctly converts storm input to runoff, triangular, and in particular bimodal, profiles were shown to reproduce adequately runoff peaks and volumes. (Author's abstract)
W88-03279

THERMAL DEVICE FOR AIRCRAFT MEASUREMENT OF THE SOLID WATER CONTENT OF CLOUDS,
Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. of Atmospheric Research.
For primary bibliographic entry see Field 7B.
W88-03282

NEAR-INFRARED EXTINCTION IN RAIN MEASURED USING A SINGLE DETECTOR SYSTEM,
University of Western Ontario, London. Faculty of Engineering Science.
For primary bibliographic entry see Field 7B.
W88-03283

RESOLUTION ENHANCEMENT OF MULTI-CHANNEL MICROWAVE IMAGERY FROM THE NIMBUS-7 SMMR FOR MARITIME RAINFALL ANALYSIS,
Wisconsin Univ., Madison. Dept. of Meteorology.
For primary bibliographic entry see Field 7C.
W88-03284

VINDICATION OF THE TWOMEY-TYPE CLOUD CONDENSATION NUCLEUS COUNTER,
Missouri Univ.-Rolla. Dept. of Mechanical and Aerospace Engineering.
For primary bibliographic entry see Field 7B.
W88-03286

IMPROVED HIGH-RESOLUTION RAINGAGE,
Auckland Univ. (New Zealand). Dept. of Physics.
For primary bibliographic entry see Field 7B.
W88-03287

QUANTITY AND QUALITY OF STORM RUNOFF IN THE IRONDEQUOIT CREEK BASIN NEAR ROCHESTER, NEW YORK, PART I, DATA-COLLECTION NETWORK AND METHODS, QUALITY-ASSURANCE PROGRAM, AND DESCRIPTION OF AVAILABLE DATA,
Geological Survey, Ithaca, NY. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03381

PRELIMINARY ASSESSMENT OF CLIMATIC CHANGE DURING LATE WISCONSIN TIME, SOUTHERN GREAT BASIN AND VICINITY, ARIZONA, CALIFORNIA, AND NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
W. G. Spaulding, S. W. Robinson, and F. L. Paillet.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4328, 1984. 40 p, 8 fig, 5 tab, 93 ref.

Descriptors: *Paleoclimates, *Paleoclimatology, *Arizona, *California, *Nevada, Great Basin Desert, Middens, Mojave, Nevada Test Site, Packrats, Quaternary.

Nine plant macrofossil assemblages from the Eleana Range-2 packrat (Neotoma sp.) midden span 6,500 radiocarbon years and record local vegetational changes in the southern Great Basin of Nevada during the last one-half of the Late Wisconsin glacial age. Climatic reconstructions were developed to account for these changes. During the late full glacial episode (17,000 to 15,000 radiocarbon years before the present), winter precipitation was about 70% greater than present winter precipitation, and summer rainfall was minimal. Average annual precipitation probably exceeded present annual precipitation by less than 40%. Annual temperatures were about 6 to 7 C lower than the present average, and evidence exists for winter temperatures much lower than those of the present. A major warming trend occurred between about 16,000 and 12,000 radiocarbon years before present. By the latest Wisconsin (12,000 to 10,000 radiocarbon years before present), annual temperatures were within 2 C of temperatures of the present. During the latest Wisconsin, precipitation was greater during the winter, relative to the present. The climate of this pluvial event was much different from that of the preceding full glacial episode and is consistent with current models of astronomically induced climatic changes. (USGS)
W88-03453

2C. Snow, Ice, and Frost

RESERVOIR BANK EROSION CAUSED AND INFLUENCED BY ICE COVER,
Cold Regions Research and Engineering Lab., Hanover, NH.
L. W. Gatto.
Available from the National Technical Information Service, Springfield, VA 22161, as ADA-124508, A03 in paper copy, A01 in microfiche. Special Report 82-31, December 1982. 26 p, 16 fig, 84 ref.

Descriptors: *Ice, *Reservoirs, *Lake ice, Ice cover, Iced lakes, Erosion, Bank erosion, Sediment erosion, Sediments, Sand, Silt.

The importance of reservoir bank erosion caused by ice cover is evaluated. This evaluation is based on a literature review and on inferences made from field observations and experience. Very little is known about the amount of reservoir bank erosion caused by the actions of an ice cover, although considerable information is available on the processes of ice-related erosion along the shorelines or beaches of oceans, rivers, or lakes. The importance of ice-related erosion along a reservoir bank seems to be determined primarily by water level. If the reservoir water level is high enough for ice to act directly on the bank face, the amount of erosion caused by ice could be substantial. If the water level is below the bank, ice would have no direct effects on it. However, ice could indirectly increase bank instability by disrupting and eroding nearshore and beach zones, which could lead to bank erosion. (Author's abstract)
W88-02889

SMALL-AREA SNOW SURVEYS ON THE NORTHERN PLAINS OF NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03057

RECENT GROWTH OF GULKANA GLACIER, ALASKA RANGE, AND ITS RELATION TO GLACIER-FED RIVER RUNOFF,
Geological Survey, Fairbanks, AK. Water Resources Div.
L. R. Mayo, and D. C. Trabant.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. Supt Doc, USGPO, Wash, DC 20402. In: USGS Water-Supply Paper 2290, 1986. p 91-100, 7 fig, 1 tab, 12 ref.

Descriptors: *Glaciers, *Climatology, *Runoff, *Alaska, Melt water, Water sources, Glacier history, Glacier stability.

A hydrologically important shift in climate within the past 10 years is indicated for a region of relatively high river runoff rates. From 1910 to 1976 Gulkana Glacier, Alaska Range, thinned and receded after a change in climate that occurred probably about 1875. Water released from glacier storage during this period augmented river runoff. Since 1976 the glacier has thickened in the accumulation zone, thinned slightly in the ablation zone, and is approaching a state of glacier mass balance and ice-flow equilibrium. Recent glacier moraines indicate that the other glaciers in the Alaska Range have receded similar amounts during the same period, which suggests that the climatic variations that affect Gulkana are widespread. River flow from the Alaska Range decreased during the period when the glaciers were thinned. This decline has ceased even though the flow is no longer augmented by glacier ice-storage losses, because the glacier growth was caused by increasing precipitation. The hypotheses that glacier growth in Alaska could signal a period of diminished streamflow is not supported. (USGS)
W88-03119

STORAGE AND RELEASE OF WATER IN A LARGE GLACIER-DAMMED LAKE: RUSSELL LAKE NEAR YAKUTAT, ALASKA, 1986,
Geological Survey, Juneau, AK. Water Resources Div.
H. R. Seitz, D. S. Thomas, and B. Thomlinson.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-545, 1986. 10 p, 9 fig, 2 tab, 6 ref.

Descriptors: *Glaciers, *Ice-dammed lakes, *Glacier surges, *Lake breakout, *Alaska, Water levels, Floods, Russell Fiord, Hubbard Glacier.

In May 1986, the entrance to Russell Fiord, Alaska, was blocked by the advancing Hubbard Glacier, forming a 34-mile long ice-dammed lake. Runoff to the lake, mainly runoff from melting snow and glacier ice, filled the lake to an elevation of 83 feet above sea level by October 8, when the ice dam failed. The lake level rose at an average rate of 0.6 ft/day, and average daily inflow to the lake was calculated to be 16,500 cu ft/sec. After failure of the ice dam, the water level fell to the former high tide level of Russell Fiord within 24 hours. Average discharge through the breach in

the ice dam during a 4-hr period of maximum water level decline is estimated to have been 3.8 million cu ft/sec. The formation and breakout of the lake is expected to be repeated as the Hubbard Glacier continues to advance, though the timing of the phenomenon cannot be predicted with certainty. (USGS)
W88-03410

2D. Evaporation and Transpiration

SURFACE GEOMETRY AND STOMATAL CONDUCTANCE EFFECTS ON EVAPORATION FROM AQUATIC MACROPHYTES,
Arizona State Univ., Tempe.
M. G. Anderson, and S. B. Idso.
Water Resources Research WRERAQ, Vol. 23, No. 6, p 1037-1042, June 1987. 7 fig, 1 tab, 18 ref.

Descriptors: *Plant physiology, *Plant tissues, *Stomatal transpiration, *Surface geometry, *Evaporation, Stomata, Transpiration, Aquatic plants, Floating plants, Water loss, Evaporation rate, Evaporation area, Canopy, Water hyacinth, Cattails, Leaves, Evapotranspiration.

Evaporative water loss rates of several floating and emergent aquatic macrophytes were studied over a 4-year period through comparison of daily evaporative water losses from similar-sized vegetated (E) and open water (E sub O) surfaces. Two species with planate floating leaves (water fern and water lily) yielded E/E sub O values of 0.90 for one and four growing seasons, respectively, and displayed stomatal regulation of potential evaporation. Water hyacinths grown in ponds with different diameters exhibited E/E sub O ratios which decreased with increasing pond diameter for both short (0.06-0.36 m) and tall (0.63-0.81 m) plants, producing higher linear correlations with amount of peripheral vegetative surface area. The latter relationships suggested that E/E sub O value less than unity for a relatively extensive canopy of short water hyacinths and a value of the order of 1.4 for a tall canopy possessing similar two-dimensional surface area characteristics. The latter results were also demonstrated in a separate study using polyurethane foam to insulate the peripheral exposure of tall water hyacinth canopies from advective energy. Finally, simultaneous stomatal conductance and daily E/E sub O measurements on cattail and water hyacinth canopies with identical tank diameters indicated that although the mean stomatal conductance of the peripheral exposure of the cattail canopy was 72% less than that of the water hyacinth canopy, its total evaporative water loss was nearly equivalent, due to its great height. Reducing the surface area of the peripheral cattail exposure by the fractional amount suggested by the stomatal conductance measurements harmonized its surface geometry-evaporation relationship with that of the water hyacinth canopy and once again demonstrated the reality of stomatal control of potential evaporation. (Author's abstract)
W88-02781

ESTIMATION OF EVAPORATION FROM NED WILSON LAKE, FLAT TOPS WILDERNESS AREA, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
N. E. Spahr, and J. T. Turk.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigation Report 85-4244, 1985. 13 p, 1 fig, 3 tab, 9 ref.

Descriptors: *Evaporation, *Lakes, *Colorado, Water budget, Mass balance, Flat Tops Wilderness, Ned Wilson Lake.

As part of an effort to define the hydrology and water quality of Ned Wilson Lake, evaporation rates were estimated for the summer periods of 1983 and 1984. Mass-transfer and energy-budget techniques and the Morton model were used to estimate evaporation using data collected at the lake and data collected at a meteorological station 0.1 mile from the lake. The estimate of evaporation for July 29 through September 27, 1983, using the mass-transfer technique, was 9.50 inches; the estimate using the energy-budget technique was 8.10 inches; the estimate using the Morton model was 9.90 inches. The evaporation estimate for July 18 through September 25, 1984, using the mass-transfer technique was 8.71 inches; the estimate using the energy-budget technique was 7.88 inches; the estimate using the Moron model was 10.49 inches. These estimates will provide values to be used in future analyses of the interaction of lake and groundwater; however, refinement of data collection will be necessary to determine specifically the rate of evaporation. (USGS)
W88-03040

SELECTED WATER-QUALITY DATA FOR THE SAN JOAQUIN RIVER AND ITS TRIBUTARIES, CALIFORNIA, JUNE TO SEPTEMBER 1985,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W88-03097

DYNAMIC RESPONSE OF THE FINE WIRE PSYCHROMETER FOR DIRECT MEASUREMENT OF WATER VAPOR FLUX,
Okayama Univ. (Japan).
For primary bibliographic entry see Field 7C.
W88-03285

2E. Streamflow and Runoff

INDICATOR BACTERIA CONCENTRATIONS AS AFFECTED BY HYDROLOGIC VARIABLES IN THE APALACHICOLA RIVER, FLORIDA,
Geological Survey, Tallahassee, FL.
For primary bibliographic entry see Field 5B.
W88-02501

OPERATIONAL FLOOD FORECASTINNG MODELS FOR MICROCOMPUTERS,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
P. Bartha, A. Szollosi-Nagy, and K. Harkanyi.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 163-178, 7 fig, 12 ref.

Descriptors: *Flood forecasting, *Computer models, *Microcomputers, *Model studies, *Computers, *Computer programs, Floods, Data acquisition, DCLM, Forecasting, Stochastic processes, Time series analysis.

In the computerized operational forecasting system developed at the Hungarian National Hydrological Forecasting Service, the data collection and communication system is telexbased and partly automatic through the TELEXDAT system. Data processing and forecasting are performed on a 64 Kbyte computer in an interactive mode. This man-machine interaction benefits from the speed of computer as well as the experience of the forecaster. Two numerical models are run in parallel as decision aids for the forecaster. The first model (DCLM) is based on the adequate discretization of the continuous Kalinin-Milyukov-Nash cascade. The residuals of the discrete deterministic model are described by ARMA models of varying order. The discrete cascade and the time series model are then entered in a structural-stochastic model whose forecasts are recursively updated by the linear Kalman-filter algorithms. The second model that acts as a back-up is an entirely stochastic time series model based upon the adaptive self-tuing principle. In summary, it is felt that models and microcomputers are excellent decision aids for the operational forecaster, yet the experiences of the forecaster should never be excluded from the process of hydrological forecasting. (See also W88-02617) (Lantz-PTT)
W88-02631

FLOOD FORECASTING FOR A LARGER CATCHMENT USING RECORDS FOR SMALLER CATCHMENTS,
Ministry of Works and Development, Christchurch (New Zealand). Hydrology Centre.
D. E. Goring, R. P. Ibbit, and M. E. U. Taylor.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 179-182, 2 fig.

Descriptors: *Flood routing, *Flood forecasting, *Catchment areas, *Data evaluation, *Floods, Data acquisition, Hydrology, Transfer function, Hydraulic studies, Hydrographs.

Two classes of flood routing techniques may be distinguished. Hydraulic methods involve the solution of the St Venant equations or approximating the. Hydrological methods use a system or 'black box' approach. The hydraulic method has two practical drawbacks. One is the necessity to have some relationship between flow and stage, which is not always available in the catchments concerned. More seriously it is difficult, if not impossible, to account for ungaged tributary flow. It was therefore decided to use a hydrological method which treated the river system as a 'black box' in which the output and some of the inputs could be measured, and to derive a relationship between these, the 'Transfer Function'. The more data available the better the estimates which can be made of the transfer functions. Over a number of implementations it has been found that 10 years of records produce enough large floods to satisfactorily identify the transfer functions. In general, use of any more than six floods does not change the transfer functions. This procedure gives a good estimate of the time of arrival of the flood peak and the shape of the hydrograph. (See also W88-02617) (Lantz-PTT)
W88-02632

USE OF MICROCOMPUTERS IN OPERATIONAL HYDROLOGY IN JAPAN,
Public Works Research Inst., Tsukuba (Japan).
F. Yoshino.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 183-193, 5 fig, 6 tab.

Descriptors: *Microcomputers, *Japan, *Hydrology, *Data processing, *Flood forecasting, Data evaluation, Mathematical studies, Rivers, Data storage and retrieval, Correlation analysis.

Of the many flood prediction systems currently used in 109 water systems in Japan, those in which microcomputers are used are described. With regard to calculation technique, almost all of the systems adopt the correlation methods such as the R-H and H-H methods, and the storage function method; The storage function system is utilized for 84 rivers, with 42 rivers having large computers, while the remaining rivers adopt microcomputers. In 2 rivers the storage function and the unsteady flow estimation (unsteady channel) technique is applied. As to data input, approximately 40% of the storage function systems adopt on-line systems. With respect to necessary time for calculation 69% of the storage function systems perform estimation within 15 minutes, yet take a longer time for rivers with complex models. (See also W88-02617) (Lantz-PTT)
W88-02633

APPLICATION OF MICROCOMPUTERS TO THE CALCULATION OF DESIGN FLOWS AND FLOOD CONTROL (MANAGEMENT OF SMALL, PARTIALLY URBANIZED CATCHMENTS),
Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. de Genie Rural.

For primary bibliographic entry see Field 7C.
W88-02637

HYDROLOGY AND DATA PROCESSING IN THE MEMBER STATES OF THE COMITE INTERAFRICAIN D'ETUDES HYDRAULIQUES (CIEH),
Comite Interafricain d'Etudes Hydrauliques, Ouagadougou (Burkina Faso).
For primary bibliographic entry see Field 7C.
W88-02638

COMPUTATION OF DESIGN FLOOD LEVELS ON MICROCOMPUTERS,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
S. Bognar, and L. Somlyody.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 239-245, 3 fig, 3 ref.

Descriptors: *Design flood, *Design flow, *Computer programs, *Flood levels, *Microcomputers, *Flood control, Mathematical studies, Channel flow, Model studies.

The most important type of information for planning flood control projects is the design flood level, which is generally determined either on the basis of observations or by calculating the steady water surface profile. The flood levels are, however, rarely associated with steady flow since at the time of flood peak the water level is also affected by the variation of discharge. Unsteady flow computations are, therefore, necessary to derive design flood level and changes in flood levels. In the present case a small HP-85 microcomputer of 32 kByte RAM was available, thus necessitating to employ an effective solution procedure for the Saint-Venant equations. The requirements of the calculations were as follows: (1) the irregularity of the natural channel had to be taken into account; (2) the boundary conditions of the model had to be consistent with the available geometric and hydrologic data; and (3) the procedure had to lead to an acceptable execution time on the microcomputer employed. Based on advanced numerical methods, a software was developed for microcomputers for calculating unsteady river flow. The application of this software allows the determination of design flood levels for different wtaer projects, and the evaluation of alternative projects for a given purpose. The software outlined here, and others similar in character are expected to have a growing interest in the hydrologic practice in the future. The major reasons are the extremely fast propagation of microcomputers outside the scientific world, the friendly nature of such machines and economic efficiency. (See also W88-02617) (Lantz-PTT)
W88-02639

FLUORIDE DISTRIBUTION AND TRANSPORT ALONG RIVERS IN THE FRENCH ALPS,
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
For primary bibliographic entry see Field 5B.
W88-02726

TRANSFER OF HYDROLOGIC INFORMATION AMONG RIVER POINTS,
George Washington Univ., Washington, DC. International Water Resources Inst.
N. Harmancioglu, and V. Yevjevich.
Journal of Hydrology JHYDA7, Vol. 91, No. 1/2, p 103-118, May 15, 1987. 11 fig, 2 tab, 5 ref. NSF Grant CEE-8405289/8541631.

Descriptors: *Rivers, *Hydrologic data, *Data interpretation, *Data acquisition, *Streamflow forecasting, *Data-value studies, Hydrologic data collections, Data collections, Correlation coefficient, Entropy coefficient, Comparison studies, Turkey, Esencay River, Transferable information, Transferred information, Mathematical equations.

Concepts of transferable and transferred information are used in tranferring hydrologic information between the river points. The former is measured by the square of entropy coefficient and the latter by the square of correlation coefficient. The entropy coefficient measures the maximum transferable information. The transfer of information along rivers has two cases. One case is when the flows of upstream stations pass through downstream stations. These upstream flows are conceived as throughflow, which along with the intermediate flow constitutes the downstream flow. The other case is when the correlation is carried out between upstream flow and the intermediate flow of downstream stations only. Daily flows of three gauging stations of the Esencay River, Turkey, are used for demonstration purpose. Series are further structurally decomposed (original data, trends removed, periodicity removed, stochastic dependence removed), in order to see effects of these characteristics on the transferable and transferred information. Some basic similarities in deterministic components of river flows are the main contributors to transferable and transferred information. The study of lag cross-correlation showed a significant increase in transferred information. (Author's abstract)
W88-02770

APPLICATION OF DISCRETE AUTOREGRESSIVE MOVING AVERAGE MODELS FOR ESTIMATION OF DAILY RUNOFF,
Ohio Univ., Athens. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W88-02771

TRANSFORMATIONS FOR IMPROVED CONVERGENCE OF DISTRIBUTIONS OF FLOOD MAXIMA TO A GUMBEL LIMIT,
Waikato Univ., Hamilton (New Zealand). Dept. of Earth Sciences.
W. E. Bardsley, and B. F. J. Manly.
Journal of Hydrology JHYDA7, Vol. 91, No. 1/2, p 137-152, May 15, 1987. 8 fig, 14 ref.

Descriptors: *Flood maxima, *Floods, *Gumbel limit, *Mathematical transformations, *Mathematical studies, *Data interpretation, *Statistical methods, Estimating, Poisson ratio, Mathematical equations.

The application of the asymptotic extreme value theory to flood maxima requires the assumption that the asymptotic condition has in fact been achieved. An alternate approach is to assume that non-Gumbel distributions of annual flood maxima are subasymptotic with respect to a Gumbel limit. Given this assumption, a power transformation and an exponential transformation are proposed to improve the convergence to the limit Gumbel distribution. An estimation procedure is given for obtaining the transformation constants. The transformations are particularly helpful if the flood generation process can be approximates by a truncated Weibull exceedance distribution combined with a Poisson exceedance frequency. (Author's abstract)
W88-02772

NONLINEAR FLOOD ROUTING WITH MULTILINEAR MODELS,
California Univ., Berkeley. Energy and Resources Group.
A. Becker, and Z. W. Kundzewicz.
Water Resources Research WRERAQ, Vol. 23, No. 6, p 1043-1048, June 1987. 7 fig, 1 tab, 18 ref.

Descriptors: *Flood routing, *Nonlinear flood routing, *Multilinear models, *Model studies, *Data interpretation, Mathematical equations, Routing, Floods, Hydrologic models.

The category of multilinear models embraces several approaches developed in apparently independent references. Multilinear modeling is a means of describing a nonlinear system with a set of linear models. This is performed by distributing the inflow to the system (river reach) into inflows to submodels and treating these inflows with a family of different operators. The models considered are nearly as simple as linear models and almost as accurate as nonlinear hydrodynamical models. (Author's abstract)
W88-02782

FLOOD GEOMORPHOLOGY OF THE KATHERINE GORGE, NORTHERN TERRITORY, AUSTRALIA,
V. R. Baker, and G. Pickup.
Geological Society of America Bulletin BUGMA, Vol. 98, p 635-646, June 1987. 16 fig, 4 tab, 51 ref. NSF Grant EAR-8300183.

Descriptors: *Flood geomorphology, *Flood flow, *Flood hydrographs, *Geomorphology, *Paleohydrology, *Erosion, *Hydrology, *Model studies, *Katherine Gorge, Australia, Sandstones, Floods, Sediment distribution, Sediment load, Sediments, Sediment sorting, Geology, Canyons.

The Katherine Gorge is a narrow, deep canyon system developed in resistant sandstone. The tropical monsoonal climate results in rare flood events of very large magnitude. These floods flush sand-sized sediment as washload through the gorge, but local accumulations are preserved as slack-water deposits at tributary mouths. Paleoflood hydrologic analysis of the deposits, employing step-backwater flow modeling, allows quantitative estimates to be made of geomorphically significant flows. For an annual exceedence probability of 0.01, the gorge may experience discharges of 6,000 cu m/sec, mean velocities of 7.5 m/sec, flow depths of 15-45 m, stream powers per unit area as great as 10000 watts/sq m, and bed shear stresses of 1500 N/sq m. Such flows are required to transport boulders 3 m or more in intermediate diameter that occur in large-scale riffles. At maximum stage, pools reach depths of 45 m and are preferentially developed at vertical joint intersections in the rock, probably through intense hydraulic action. Pool-and-riffle development thus reflects the channel boundary characteristics for extreme flow conditions. Additional indicators of especially intense flow phenomena include potholes, flutes, abraded facets on rock bar surfaces, and scabland development on upland bedrock surfaces. (Author's abstract)
W88-02793

GAS-CHROMATOGRAPHIC ELEMENTAL ANALYSIS VIA DI(TRIFLUOROETHYL) DITHIOCARBAMATO CHELATES: X. CAPILLARY GAS CHROMATOGRAPHY AT THE PG-LEVEL - DETERMINATION OF CO AND CR(VI) BESIDES CR(III) IN RIVER WATER,
Mainz Univ. (Germany, F.R.). Inst. fuer Anorganische Chemie und Analytische Chemie.
For primary bibliographic entry see Field 5A.
W88-02817

EFFECT OF ENVIRONMENTAL FACTORS ON COLIPHAGES IN THE WELSH RIVER DEE,
University Coll., Galway (Ireland). Dept. of Microbioloby.
For primary bibliographic entry see Field 2H.
W88-02876

WORLD CATALOGUE OF MAXIMUM OBSERVED FLOODS,
Office de la Recherche Scientifique et Technique Outre-Mer, Bondy (France).
For primary bibliographic entry see Field 7C.
W88-02926

EVALUATION OF PHYSICAL AND NUMERICAL HYDRAULIC MODELS, MASONBORO INLET, NORTH CAROLINA,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 8B.
W88-02939

USE OF THE ROUTING PROCEDURE TO STUDY DYE AND GAS TRANSPORT IN THE WEST FORK TRINITY RIVER, TEXAS,
Geological Survey, Bay Saint Louis, MS. Water Resources Div.

For primary bibliographic entry see Field 5B.
W88-02953

STREAMFLOW AND SPECIFIC-CONDUCTANCE DATA FOR BEAR CREEK, AUGUST 13, 1985, THE OAK RIDGE RESERVATION, TENNESSEE,
Geological Survey, Knoxville, TN. Water Resources Div.
R. D. Evaldi.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-682, 1986. 8 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Water quality, *Specific conductance, *Discharge measurement, *Tennessee, Base flow, Groundwater flow, Oak Ridge, Bear Creek.

Discharge and specific conductance were measured August 13, 1985, during low base flow of Bear Creek in the vicinity of the Y-12 Plant on the Oak Ridge Reservation, Tennessee. Discharge of Bear Creek and its tributaries measured at specific sites ranged from 0 to 1.0 cubic foot per second. Specific conductance ranged from 225 to 7600 microsiemens per centimeter at 25 degrees Celsius. During the time of instantaneous discharge measurements, flow of Bear Creek at the continuous-record station at Highway 95 near Oak Ridge ranged from 0.59 to 0.63 cubic foot per second. (USGS)
W88-02954

STEADY-STATE COMPUTER MODEL OF THE WATER-TABLE AQUIFER IN THE MULLICA RIVER BASIN, THE PINE BARRENS, NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-02972

LOW-FLOW FREQUENCY ANALYSES FOR STREAMS IN WEST-CENTRAL FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
K. M. Hammett.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4299, 1985. 116 p, 8 fig, 6 tab, 39 ref.

Descriptors: *Low flow, *Frequency analysis, *Regression analysis, Base flow, Water supply, Surface-groundwater relations, Florida.

The log-Pearson type III distribution was used for defining low-flow frequency at 116 continuous-record streamflow stations in west-central Florida. Frequency distributions were calculated for 1, 3, 7, 14, 30, 60, 90, 120, and 183 consecutive-day periods for recurrence intervals of 2, 5, 10, and 20 years. Discharge measurements at more than 100 low-flow partial-record stations and miscellaneous discharge-measurement stations were correlated with concurrent daily mean discharge at continuous-record stations. Estimates of the 7-day, 2-year; 7-day, 10-year; 30-day, 2-year; and 30-day, 10-year discharges were made for most of the low-flow partial-record and miscellaneous discharge-measurement stations based on those correlations. Multiple linear-regression analysis was used in an attempt to mathematically relate low-flow frequency data to basin characteristics. The resulting equations showed an apparent bias and were considered unsatisfactory for use in estimating low-flow characteristics. Maps of the 7-day, 10-year and 30-day, 10-year low flows are presented. Techniques that can be used to estimate low-flow characteristics at an ungaged site are also provided. (USGS)
W88-02979

HYDROLOGY AND WATER QUALITY OF THE ELK CREEK BASIN, WEST-CENTRAL WISCONSIN--AN ASSESSMENT OF NON-POINT DISCHARGES,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03016

SELECTED HYDROGRAPHS AND STATISTICAL ANALYSES CHARACTERIZING THE WATER RESOURCES OF THE ARKANSAS RIVER BASIN, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
A. W. Burns.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4264, 1985. 199 p, 136 fig, 143 tab, 1 plate (map).

Descriptors: *Hydrograph analysis, *Hydrographs, *Statistical analysis, *Arkansas River basin, *Colorado, *Rainfall-runoff relationships, Streamflow, Water yield.

Hydrographs of annual precipitation from 30 stations, April 1 snowpack readings from 18 snow-survey courses, annual discharge from 46 streamflow gaging stations, and instantaneous water levels from 37 wells are presented to illustrate the temporal and spatial variability of the water resources of the Arkansas River basin in Colorado. Statistical analyses indicate no apparent time trends in annual precipitation or April 1 snowpack, but they do indicate declines in annual discharge for locations in the eastern part of the basin. A composite hydrograph indicates a negligible change in groundwater levels between 1930 and 1980 in the alluvial aquifer downstream from Pueblo. Generally poor correlation occurs between precipitation data and snowpack data (less than 0.40 for monthly data and less than 0.61 for annual data). In addition, precipitation data did not correlate very well with discharge (less than 0.57 for monthly data), leading to the conclusion that the typical streamflow conditions are affected little by direct precipitation. Main-stem discharge correlates quite well with snow-pack (as much as 0.85 for annual data), indicating its dependence on snowmelt runoff. (USGS)
W88-03022

INVESTIGATION OF THE NEED FOR DISCHARGE ADJUSTMENTS FOR UNSTEADY FLOW AT SELECTED GAGING STATIONS ON TENNESSEE STREAMS,
Geological Survey, Memphis, TN. Water Resources Div.
B. L. Neely, and R. H. Bingham.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4144, 1986. 21 p, 22 fig, 2 tab, 3 ref.

Descriptors: *Streamflow, *Stage, *Stage-discharge relations, *Channel storage, *Slope, *Tennessee, Gaging stations, Slope gages, Wave velocity, Constant flow, Constant stage, Constant slope.

Measured discharges made during rising or falling stages generally require adjustments to refine constant-stage rating curves (stage-discharge relations) for gaged sites. Measurements at 42 gaging stations on Tennessee streams were selected for adjustment. Two methods, generally accepted by the U.S. Geological Survey, were tested: (1) the slope method adjusts the discharge for changing slope during the measurement, and (2) the storage method adjusts for change in channel storage. Both methods are related to the rate of change in stage. The initial results of the storage method of adjustments were unsatisfactory because of uncertainty in determining channel storage at each site, and a specific trend in the results could not be defined. Consequently, the storage method of adjustment was deleted from successive analyses. Maximum adjustments in measured discharge using the slope method were less than 5 percent at 28 of the 42 stations and less than 10 percent at 39 of the 42 stations used in the analyses. The adjustments were small because most of the measurements were made during nearly stable stage. Adjustments of measurements made during stage changes of several feet per hour could be considerably larger than 10 percent. Stage records at 10 stations showed that maximum change in stage during rises were considerably higher than the change in stage observed during the measurements. Large adjustments are usually required for a short period of time on the rising side of a hydrograph and smaller adjustments are required for a longer period of time on the falling side. Maximum adjustments in discharge using the slope method were less than 5 percent at three of the 10 stations and less than 30 percent at eight of the 10 stations used in the analyses. The mean discharge for the adjusted and unadjusted hydrographs are about the same. (USGS)
W88-03026

ESTIMATED MONTHLY PERCENTILE DISCHARGES AT UNGAGED SITES IN THE UPPER YELLOWSTONE RIVER BASIN IN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
C. Parrett, and J. A. Hull.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4009, 1986. 34 p, 4 fig, 11 tab, 6 ref.

Descriptors: *Discharge measurement, *Streamflow, *Yellowstone River, *Montana, Flow duration, Regression analysis.

Once-monthly streamflow measurements were used to estimate selected percentile discharges on flow-duration curves of monthly mean discharge for 40 ungaged stream sites in the upper Yellowstone River basin in Montana. The estimation technique was a modification of the concurrent-discharge method previously described and used by H.C. Riggs to estimate annual mean discharge. The modified technique is based on the relationship of various mean seasonal discharges to the required discharges on the flow-duration curves. The mean seasonal discharges are estimated from the monthly streamflow measurements, and the percentile discharges are calculated from regression equations. The regression equations, developed from streamflow record at nine gaging stations, indicated a significant log-linear relationship between mean seasonal discharge and various percentile discharges. The technique was tested at two discontinued streamflow-gaging stations; the differences between estimated monthly discharges and those determined from the discharge record ranged from -31 to +27 percent at one site and from -14 to +85 percent at the other. The estimates at one site were unbiased, and the estimates at the other site were consistently larger than the recorded values. Based on the test results, the probable average error of the technique was + or - 30 percent for the 21 sites measured during the first year of the program and + or - 50 percent for the 19 sites measured during the second year. (USGS)
W88-03037

WATER QUALITY OF STREAMS IN SANTA CLARA VALLEY, SANTA CLARA COUNTY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03038

SURFACE-WATER QUALITY OF COAL-MINE LANDS IN RACCOON CREEK BASIN, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03041

WATER-QUALITY CONDITIONS AND AN EVALUATION OF GROUND- AND SURFACE-WATER SAMPLING PROGRAMS IN THE LIVERMORE-AMADOR VALLEY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03058

COST-EFFECTIVENESS OF THE U.S. GEOLOGICAL SURVEY'S STREAM-GAGING PROGRAMS IN MASSACHUSETTS AND RHODE ISLAND,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03059

COST EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03061

OPERATING MANUAL FOR THE DIGITAL DATA-COLLECTION SYSTEM FOR FLOW CONTROL STRUCTURES,
Geological Survey, NSTL Station, MS. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03067

ANNOTATED BIBLIOGRAPHY OF THE GEOLOGY, HYDROLOGY, AND GEOTHERMAL RESOURCES OF THE JEMEZ MOUNTAINS AND VICINITY NORTH CENTRAL NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 10C.
W88-03068

WATER RESOURCES ACTIVITIES IN NEW YORK 1985-86,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03073

USE AND AVAILABILITY OF CONTINUOUS STREAMFLOW RECORDS IN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03079

WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN WYOMING, FISCAL YEAR 1985,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03081

DRAINAGE-AREA DATA FOR WISCONSIN STREAMS,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03082

ANNUAL YIELD AND SELECTED HYDROLOGIC DATA FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS-OKLAHOMA, 1985 WATER YEAR,
Geological Survey, Little Rock, AR. Water Resources Div.
M. A. Moore, and T. E. Lamb.
Available from USGS, OFSS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 86-66, 1986. 39 p, 1 fig, 3 tab, 2 ref.

Descriptors: *Interstate compacts, *Stream discharge, *Arkansas, *Oklahoma, *Arkansas River Basin, Reservoir storage, Water quality, Water yield, Annual yield, River basins.

The computed annual yield and deficiency of the subbasins as defined in the Arkansas River Compact, Arkansas-Oklahoma, are given in tables. Actual runoff from the subbasins and depletion caused by major reservoirs in the compact area are also given in tabular form. Monthly, maximum, minimum, and mean discharges are shown for the 14 streamflow stations used in computing annual yield. Water-quality data are shown for four sites in the compact area. (USGS)
W88-03085

DISCHARGE AND WATER QUALITY OF HORSE CREEK, SOUTHEASTERN WYOMING, MAY-NOVEMBER 1985,
Geological Survey, Casper, WY. Water Resources Dib
J. F. Meyer, and L. W. Lenfest.
Available from USGS, OFSS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 86-69, 1986. 16 p, 12 fig, 6 tab, 3 ref.

Descriptors: *Stream discharge, *Water quality, *Wyoming, Hydrogen ion concentration, Specific conductivity, Water temperature, Horse Creek.

This report presents stream-discharge and water-quality data collected at five sites in the lower Horse Creek drainage of southeastern Wyoming, May through November, 1985. Data include stream-discharge measurements; field measurements of specific conductance, pH, and water temperature; and computer changes in stream discharge. Measured discharge in Horse Creek ranged from 0.91 to 172 cu ft/sec. Values of pH averaged 8.4. Water temperature ranged from 0 to 27 C. The data are presented in graphs and tables. A map of the study reach shows the location of the data collection sites. (USGS)
W88-03086

HYDROLOGIC DATA FROM ROAN CREEK AND PARACHUTE CREEK BASINS, NORTHWESTERN COLORADO,
Geological Survey, Grand Junction, CO. Water Resources Div.
D. B. Adams, K. E. Goddard, R. O. Patt, and K. C. Galyean.
Available from USGS, OFSS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 83-859, 1986. 115 p, 3 plates (maps), 35 fig, 12 tab, 28 ref.

Descriptors: *Hydrologic data, *Colorado, Hydrology, Water quality, Surface water, Groundwater, Springs, Water levels, Stream biota, Piceance Creek structural basin, Oil shale, Garfield County.

Hydrologic data obtained from a comprehensive study of the Roan Creek and Parachute Creek basins are presented in this report. The purpose of this study was to inventory and appraise the predevelopment hydrologic conditions in these basins. The study was conducted from October 1975 through September 1981 and was one of several studies of oil-shale areas in the Western United States conducted by the U.S. Geological Survey. Data collected prior to October 1975 are presented, and references to other reports covering this area are given. Data collected include information from 58 wells, 286 springs, 14 streamflow-gaging stations and 24 miscellaneous surface water sites. Surface-water discharge, chemical-quality, and sediment data from streamflow-gaging stations in the basin are published in other reports listed in the references. (USGS)
W88-03092

1980 POLLALLIE CREEK DEBRIS FLOW AND SUBSEQUENT DAM-BREK FLOOD, EAST FORK HOOD RIVER, OREGON,
Geological Survey, Vancouver, WA. Water Resources Div.
For primary bibliographic entry see Field 2J.
W88-03104

EXTENSION OF THE UNSTEADY ONE-DIMENSIONAL OPEN-CHANNEL FLOW EQUATIONS FOR FLOW SIMULATION IN MEANDERING CHANNELS WITH FLOOD PLAINS,
Geological Survey, Bay Saint Louis, MS. Water Resources Div.
L. L. DeLong.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. Supt Doc, USGPO, Wash, DC 20402. In: USGS Water-Supply Paper 2290, 1986. p 101-106, 6 fig, 8 ref.

Descriptors: *Open-channel flow, *Flood routing, Unsteady flow, Sinuous flow, Flood plains, Mathematical models, Meanders, One-dimensional flow equations.

Unsteady flow simulation in natural rivers is complicated by significant variation in hydraulic properties as a meandering river innundates a flood plain. The unsteady, one-dimensional, open-channel flow equations are generalized to include variation in channel length with depth of flow. Hydraulic properties of complex channel cross sections are repesented through variation of momentum coefficients and conveyance with depth flow. Flood peaks were numerically routed through hypothetical rivers with and without meanders, and downstream hydrographs were compared at equivalent main-channel distance. Flood-plain innundation during high flow reduced effective channel length of the meandering river and resulted in nearly a one-third reduction in flood-peak travel time. The governing equations were solved using an orthogonal-colliocation, finite-element method, formulated in terms of cross-sectional area and discharge. Though the main-channel and flood plain are treated as a continuous cross-sectional area, top width does not appear directly in the governing equations or numerical computations. Consequently, the sudden expansion in top width as flow spills onto the flood plain does not cause this method to fail as it commonly has other methods formulated in terms of depth of flow or stage, top width, and discharge. (USGS)
W88-03120

COMPARISON OF TWO STREAM-DISCHARGE RECORD RECONSTRUCTION TECHNIQUES FOR EIGHT GAGING STATIONS IN MAINE,
Geological Survey, Augusta, ME. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03121

COMPARISON OF VELOCITY-AREA INTERPOLATION METHODS FOR COMPUTING OPEN-CHANNEL DISCHARGE,
Geological Survey, Atlanta, GA. Water Resources Div.
J. M. Fulford, and V. B. Sauer.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. Supt Doc, USGPO, Wash, DC 20402. In: USGS Water-Supply Paper 2290, 1986. p 139-144, 4 fig, 1 tab, 2 ref.

Descriptors: *Surface water, *Discharge computation, *Streamflow measurement, *Flow measurement, Rivers, Mississippi River, Ohio River.

The Dutch have suggested the use of the ratio of velocity to the square root of depth in velocity-area computations of open-channel discharge to minimize the number of velocity measurements needed. This study tested the Dutch method as well as three other discharge computation methods on data from the Mississippi and Ohio Rivers and seven smaller rivers in Georgia and South Carolina. Results from all the methods are compared with a 'true' discharge computed by the standard mid-section method. Mean absolute error for the methods using all the measured cross section depths with a velocity approximation scheme ranged from 10.2 percent to 1.1 percent. For the method using only depths measured with the velocity, the mean absolute error ranged from 51.2 percent to 4.4 percent. Results from the study indicated that the use of five velocity measurements in a known cross section might be adequate to compute discharges using the Dutch method or a more simple linear interpolation scheme. (USGS)
W88-03124

PRELIMINARY EVALUATION OF A DISCHARGE COMPUTATION TECHNIQUE THAT USES A SMALL NUMBER OF VELOCITY OBSERVATIONS,

Geological Survey, Columbia, SC. Water Resources Div.
L. R. Bohman, and W. J. Carswell.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. Supt Doc, USGPO, Wash, DC 20402. In: USGS Water-Supply Paper 2290, 1986. p 145-154, 6 fig, 4 tab, 4 ref.

Descriptors: *Discharge measurement, *Streamflow measurement, *Velocity distribution, *Flow measurement research, Flow discharge, Tidal rivers, Steady flow, Unsteady flow, Midsection method.

A preliminary evaluation was made of a method for discharge computation that uses a small number of vertical velocity observations and a known channel cross section to synthesize a lateral velocity distribution. The technique is discussed and discharges from 25 current meter measurements computed by the midsection method were compared to the new technique when using three, five, and seven velocity observations. Results indicate the new technique may overestimate discharge. Percent differences ranged from -38.3 to +28.5 and decreased as either the number of velocity observations or of discharge increased. It may be possible to optimize the number and location of observed verticals. The results of this investigation indicate that further analysis of the new technique is warranted. (USGS)
W88-03125

HYDROLOGIC RECONNAISSANCE AND SUMMARY OF EXISTING DATA ON SURFACE AND GROUNDWATER RESOURCES IN THE MISSOURI RIVER VALLEY IN WOODBURY AND MONONA COUNTIES, IOWA, 1985,
Geological Survey, Iowa City, IA. Water Resources Div.
R. C. Buchmiller.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-144, 1986. 21 p, 11 fig, 3 tab, 17 ref.

Descriptors: *Alluvial aquifers, *Surface-groundwater relations, *Water level fluctuations, *Missouri River, *Iowa, Groundwater recharge, Groundwater movement, Woodbury County, Monona County.

A hydrologic reconnaissance of the Missouri River valley in western Iowa was begun in 1985. The study area is about 400 sq mi of Missouri River flood plain used mainly for agricultural purposes and is located mostly in parts of Woodbury and Monona Counties, Iowa. The reconnaissance was conducted to determine the extent of hydrologic information available for the study area and to determine if the existing data base is sufficient to support an interpretive investigation to quantify the groundwater/surface water relationships in the area. Extensive information concerning the surface water resources of the area, particularly the Missouri River, is available. Very little information concerning the geometry, hydraulic characteristics and groundwater flow relationships in the alluvial aquifer is available. Information needs to be collected to create an adequate data base for future simulation of groundwater flow and to calibrate any estimates of flow. (USGS)
W88-03129

HYDROLOGIC DATA FROM NAVAL OIL SHALE RESERVES, PARACHUTE CREEK BASIN, NORTHWESTERN COLORADO, WATER YEARS 1982-83,
Geological Survey, Grand Junction, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03131

FLOODS IN SOUTH-CENTRAL IOWA,
Geological Survey, Iowa City, IA. Water Resources Div.
A. J. Heinitz.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-100, 1986. 20 p, 30 fig, 4 tab, 8 ref.

Descriptors: *Floods, *Iowa, *Surface runoff, *Historic floods, *Flood profiles, River flow, Hydrology, Water resources development, Flooding, Cedar Creek basin, Chariton River basin, South River basin, White Breast Creek basin, Highwater marks.

Flood profiles and discharges for the great floods of 1981 and 1982 in south-central Iowa are given. The profiles cover the South River, Squaw Creek, Otter Creek, White Breast Creek, Cedar Creek, North Cedar Creek, Chariton River and the South Fork Chariton River. The July 3, 1982, flood-peak discharge at the Cedar Creek gaging stations (05489000) near Bussey was 4.4 times that of the regional 100-year flood to rank as one of the greatest floods ever recorded in the state. Flood peak discharges determined on other streams ranged up to 2.4 times that of the regional 100-year flood discharge. Flood-frequency discharges for the Cedar Creek basin are greater than 2 times those defined by regional relations. These high flood peaks are probably caused from basin characteristics not yet defined. (USGS)
W88-03132

SELECTED PUBLICATIONS ON THE WATER RESOURCES OF VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
For primary bibliographic entry see Field 10C.
W88-03135

STAGE-DISCHARGE RELATIONS FOR TOMBIGBEE RIVER AT ALICEVILLE LOCK AND DAM, NEAR PICKENSVILLE, ALABAMA--UPDATED 1985,
Geological Survey, Montgomery, AL. Water Resources Div.
G. H. Nelson, and C. O. Ming.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-284, 1986. 8 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Stage-discharge relations, *Floods, *Rating curves, *Control structures, *Backwater, *Tennessee-Tombigbee Waterway, *Tombigbee River, *Aliceville Lock and Dam, Streamflow, Water levels, Pickens County, Alabama.

Preliminary stage-discharge relations (limit curves) have been defined for Aliceville Lock and Dam covering the period February 1980 to May 1983 (Nelson and Ming, 1983). Subsequent data collected at the dam indicates a need for a revision to the preliminary curves. Due to channel instability in the vicinity, periodic review and possible update will be needed to keep the curves current. Using 48 data points defined by the flood of December 1983, the curves have been updated and are shown in this 1985 report. (USGS)
W88-03136

WATER-RESOURCES DATA FOR THE MOUNT SHASTA AREA, NORTHERN CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
K. R. Poeschel, T. G. Rowe, and J. C. Blodgett.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-65, 1986. 73 p, 13 fig, 12 tab, 15 ref.

Descriptors: *Water quality, *Spring waters, *Surface waters, Stream discharge, Sediment concentration, Groundwater levels, California, Mount Shasta.

This report presents water quantity and water quality data for samples collected at wells, springs, streams, and lakes in the vicinity of Mount Shasta in northern California. The data are presented in graphs and tables. Groundwater data include water level measurements made at 24 wells, analyses of water samples collected at 12 wells, discharge measurements made at 14 springs, and analyses of water samples collected at 17 springs. Surface water data include streamflow measurements and/or analyses of suspended sediment collected at 36 stream sites; analyses of water samples collected at 11 streamflow sites; profiles of temperature, specific conductance, dissolved oxygen, and pH for water samples from 6 lake sites; and analyses of water samples collected at 7 lake sites. Maps of the area show the location of data-collection sites. (USGS)
W88-03138

CURRENT WATER RESOURCES ACTIVITIES IN ALABAMA, FISCAL YEAR 1986,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03140

COASTAL-A DISTRIBUTED HYDROLOGIC SIMULATION MODEL FOR LOWER COASTAL PLAIN WATERSHEDS IN GEORGIA,
Georgia Univ., Athens. Dept. of Geography.
C. Sun, and G. A. Brook.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-164209/AS. Price codes: A06 in paper copy, A01 in microfiche. Report No. ERC 06-85. Environmental Resources Center, Georgia Institute of Technology, Atlanta. August 1985. 100 p, 1 tab, 1 fig, 55 ref. Project No. USGS G-900-03.

Descriptors: *Simulation, *Georgia, *Coastal Plain, *Surface-groundwater relationships, *Mathematical models, Hydrology, Groundwater, Streamflow, Watersheds, Model studies.

Overland flow to streams is rare in the Lower Coastal Plain watersheds of Georgia. As a result, commonly-used watershed hydrologic simulation models can not be used to predict streamflow accurately. Therefore, a distributed watershed hydrologic simulation model, named COASTAL, has been developed specifically for the Lower Coastal Plain regions of Georgia, Florida, and South Carolina. A basic assumption of the model, which can be run on a personal computer, is that all streamflow results from groundwater discharge into stream channels. COASTAL was developed by combining surface and groundwater simulation models. In modelling, the watershed is divided into rectangular grid elements. Input data for each grid element can be obtained easily from topographic maps, soil surveys, aerial photographs, and generalized published tables. At least one year of measured daily streamflow data is needed to calibrate the model. Outputs from the model include daily stream discharge, a water budget, and average daily groundwater level for each grid element within the watershed. The model has been tested using data for the Hurricane Creek watershed of Georgia. Correlation coefficients between simulated and measured streamflow were in the range 0.8 to 0.9. Work is presently underway to improve COASTAL by installing an automatic calibration module. (Sun-U. GA)
W88-03154

BASINWIDE INSTREAM FLOW ASSESSMENT MODEL TO EVALUATE INSTREAM FLOW NEEDS,
Illinois State Water Survey Div., Champaign.
K. P. Singh, and S. M. Broeren.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-151693/AS. Price codes: A06 in paper copy, A01 in microfiche. Illinois Water Resources Center, Urbana. Final Project Completion Report 197. November 1985. 97 p, 94 fig, 12 tab, 27 ref. Contract No. 14-08-0001-G904. Project No. USGS G904-06.

Descriptors: Description: *Illinois, *Instream flow requirements, *Model studies, *Water allocation, Water resources, Water resources research.

Quantification of sufficient or minimum flows needed to sustain the aquatic habitat is necessary for satisfactory resolution of water use conflicts and planning of water allocation strategies. The Instream Flow Group (IFG) of the U.S. Fish and Wildlife Service has developed a methodology to gage the quantity of suitable habitat in a stream. Application of the methodology requires informa-

tion on the local variations of depth and velocity in a stream reach. Convenient flow models are inadequate for this application, and evaluation of aquatic habitats requires extensive field work. Results obtained in a study reach cannot be applied to other reaches with dissimilar areas. To address the problem of defining the local variation of depths and velocities for regional habitat evaluation, a probabilistic flow model is developed. The probabilistic model incorporates hydraulic geometry relationships to evaluate average flow parameter values without the necessity of field observations. Local variations of depth and velocity values are evaluated from probability distribution models developed from field data collected on the Sangamon and South Fork Sangamon River Basins. The flow model simulation for calculating stream habitat suitability with the IFG methodology is illustrated. (Singh-U IL)
W88-03164

APPLICATION OF THE PRINCIPLE OF MAXIMUM ENTROPY (POME) TO HYDROLOGIC FREQUENCY ANALYSIS,
Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
V. P. Singh, K. Singh, and A. K. Rajagopal.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-170420/AS. Price codes: A08 in paper copy, A01 in microfiche. Louisiana Water Resources Research Institute Project Completion Report. 1985. 144 p, 8 fig, 12 tab, 68 ref. Contract No. 14-08-0001-G-909. Project No. USGS G909-05.

Descriptors: *Instantaneous unit hydrographs, *Principle of maximum entropy, *Unit hydrographs, *Hydrologic frequency analysis, Cumulative density function, Entropy, Frequency curves, Lagrange multipliers, Probability density function, Shannon entropy functional, Watersheds.

The principle of maximum entropy (POME) was employed to develop a procedure for derivation of a number of frequency distributions used in hydrology for performing flood frequency and risk analysis. The procedure required specification of constraints and maximization of entropy, and was thus a solution of the classical optimization problem. The POME led to a unique technique for parameter estimation. Two cases were considered to illustrate application of POME: (1) representation of the instantaneous unit hydrograph (IUH) and evaluation of methods of its fitting, and (2) performing flood frequency analysis using two-parameter gamma distribution and Pearson type III distribution. Data on four rainfall-runoff events from a large outdoor rainfall-runoff experimental facility were used for fitting the IUH by five different methods. POME yielded either comparable or superior IUH's. For six selected river gaging stations, parameters of the gamma distribution, fitted to annual maximum discharges, were evaluated by POME and compared with those obtained by using the methods of moments (MOM) and maximum likelihood estimation (MLE). The concept of entropy, used as a measure of uncertainty associated with a specified distribution, facilitated this comparison. POME was found to be identical to MLE and superior to MOM. The same was done for Pearson type III distribution. In this case, POME and MLE yielded almost identical parameter estimates, and were comparable to MOM. (Singh-LA. St. U.)
W88-03181

ANALYSIS AND GENERATION OF LOW FLOW SEQUENCES FOR IDAHO STREAMS USING DISAGGREGATION MODELING,
Idaho Univ., Moscow. Water Resources Research Inst.
D. R. Horn, and D. Dieziger-Kim.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-198124/AS. Price codes: A15 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute Completion Report, Moscow. September 1985. 314 p, 94 fig, 118 tab, 43 ref, 6 append. Project No. USGS G903-03.

Descriptors: *Stochastic hydrology, *Streamflow forecasting, *Lowflow, *Idaho, Stochastic models, Planning, Droughts, Mathematical models, Statistical models, Disaggregation models, Model studies.

Stochastic models of streamflow were developed for two rivers in Idaho, and the results analyzed to assess model performance and the characteristics of droughts. Multivariate modeling methods were applied to both historical records to extend their length, based on nearby longer-term records, and the unextended and extended data were then used to determine subsequent model parameters. Annual flow models, coupled with condensed parameter disaggregation models, were applied to generate 40,000 years of annual/monthly streamflow records. The statistics and probability distributions of the annual and monthly flows comprising drought sequences are presented, and the theory of runs is used to estimate return periods of historical drought events. It is concluded that the assignment of probabilities to droughts based on historical record length yields inconsistent results when compared to the long-term stochastic process, and that data extension has a significant effect on critical model and run-definition parameters, providing improved estimates of population statistics. Procedures are suggested for using the modeling results for storage reservoir design, and for developing regionalized drought characteristics for Idaho streams. (Horn-IWRRI)
W88-03189

HYDROLOGICAL MODELLING OF THE SUDD AND JONGLEI CANAL,
Institute of Hydrology, Wallingford (England).
J. V. Sutcliffe, and Y. P. Parks.
Hydrological Sciences Journal HSJODN, Vol. 32, No. 2, p 143-159, June 1987. 8 fig, 4 tab, 13 ref.

Descriptors: *Hydrologic budget, *Flood profiles, *Hydrologic models, *Floods, *Canals, *Model studies, *Sudd canal, *Sudan, *Jonglei Canal, Africa, Mathematical studies, Mathematical equations, Flooding, Historic floods, Swamps.

The water balance of the Sudd, Sudan is represented by a hydrological model which uses measured inflows and outflows and estimates of rainfall and evaporation to reproduce volumes and areas of flooding over the historical period 1905-1980. Predicted outflows based on inflows are then substituted for measured outflows so that the proposed diversions through the Jonglei Canal can be incorporated in the model in order to predict the effects of the canal on areas of flooding. (Author's abstract)
W88-03274

SIMULATION OF RUNOFF AND NITROGEN LEACHING FROM TWO FIELDS IN SOUTHERN SWEDEN,
Sveriges Meteorologiska och Hydrologiska Inst., Norrkoeping.
S. Bergstrom, M. Brandt, and A. Gustafson.
Hydrological Sciences Journal HSJODN, Vol. 32, No. 2, p 191-205, June 1987. 12 fig, 11 ref.

Descriptors: *Runoff, *Nitrogen leaching, *Hydrologic models, *Model studies, *Simulation analysis, *Path of pollutants, *Data interpretation, *Leaching, Nitrogen, Infiltration, Percolation, Water pollution sources, Mathematical studies, Mathematical equations, Agricultural runoff.

A conceptual model for the simultaneous computation of runoff and inorganic nitrogen leaching is described. The model is semi-empirical with coefficients that are calibrated against observed data. Two applications of the model, using well-controlled data from small fields of arable land in southern Sweden, are demonstrated. These show that a major part of the variations of concentrations of inorganic nitrogen in runoff water can be explained by this model approach. Finally, the sensitivity and limitations of this type of model are discussed. (Author's abstract)
W88-03277

STRUCTURE OF A SEMI-DISTRIBUTED ADAPTIVE MODEL FOR FLOOD FORECASTING,
Consiglio Nazionale delle Ricerche, Perugia (Italy). Ist. di Ricerca per la Protezione Idrogeologica nell' Italia Centrale.
C. Corradini, F. Melone, and V. P. Singh.
Hydrological Sciences Journal HSJODN, Vol. 32, No. 2, p 227-242, June 1987. 1 fig, 5 tab, 17 ref. NSF Project NSF-INT 84-00205.

Descriptors: *Flood forecasting, *Rainfall-runoff relationships, *Model studies, Forecasting, Mathematical models, Mathematical studies, Mathematical equations, Model testing, Runoff, Storm runoff, Infiltration, Surface detention.

Eight different versions of a simple rainfall-runoff adaptive model for on-line flood forecasting are formulated in a framework characterized by an ensemble of spatially uniform units. The main loss from rainfall is considered to be infiltration which is represented by an extended formulation of a point approach utilizing a two-branched scheme for time to ponding and soil infiltration capacity. The differences among the model versions are due to the computation of effective rainfall, the treatment of the transformation process from effective rainfall to direct runoff, and the estimation of surface retention. The various model versions were tested by their application to events observed on a large Italian basin. By a comparison of their forecasts with those of a no-model approach and the estimation of errors in peak runoff, it was found that two of the models were more appropriate and provided flow forecasts sufficiently accurate for forecast lead times up to 6 hours. (Author's abstract)
W88-03280

NUMERICAL SIMULATION OF STORM SURGES IN BANGLADESH USING A BAY-RIVER COUPLED MODEL,
Indian Inst. of Tech., New Delhi. Centre for Atmospheric and Fluids Sciences.
For primary bibliographic entry see Field 7C.
W88-03296

SUPPLEMENT TO INVENTORY AND ANALYSES OF INFORMATION FOR FLOOD PLAIN MANAGEMENT IN NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
D. G. Emerson, and J. D. Wald.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-700, 1985. 80 p, 1 fig, 2 tab, 63 ref.

Descriptors: *Flood data, *Flood hazard information, *North Dakota, Flood plain management.

Governmental units that have been identified as having flood hazard areas but do not have detailed base flood information are required to use the 'best available data' to regulate new development or expansion of existing development in flood prone areas. Information for flood plain management has been identified for 31 governmental units in North Dakota and includes the determination of what data are available regarding flood hazards, hydraulics, and hydrology, and a review of these data to determine their adequacy for use in flood plain management. (USGS)
W88-03299

STREAMFLOW STATISTICS AND DRAINAGE BASIN CHARACTERISTICS FOR THE SOUTHWESTERN AND EASTERN REGIONS, WASHINGTON, VOLUME I. SOUTHWESTERN WASHINGTON; VOLUME II. EASTERN WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
J. R. Williams, and H. E. Pearson.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 84-145-A and -B, 1985. 1086 p, 2 fig, 2 pl.

Descriptors: *Streamflow, *Washington, Stream discharge, Mean discharge, Flow duration, Low flow, High flow, Flood frequency.

Monthly and annual mean discharges and statistics, low-flow and high-flow analyses, flow duration, and flood frequency data are tabulated for eastern and southwestern Washington State for all gaging stations with 5 or more years of record, through 1979. The sites are in the area draining to the Pacific Ocean from Cape Flattery to the mouth of the Columbia River and also the drainage of the lower Columbia River from its mouth upstream through the Little White Salmon River basin and all drainage areas east of the Cascade Mountains. (USGS)
W88-03301

WATER-RESOURCES ACTIVITIES IN UTAH BY THE U.S. GEOLOGICAL SURVEY, JULY 1, 1985 TO JUNE 30, 1986,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03302

ANALYSIS OF FLOOD-FLOW FREQUENCY FOR SELECTED GAGING STATIONS IN SOUTH DAKOTA THROUGH SEPTEMBER 1985,
Geological Survey, Huron, SD. Water Resources Div.
E. B. Hoffman, M. E. Freese, and D. R. Winter.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-496, 1986. 137 p, 2 fig, 186 tab, 6 ref.

Descriptors: *Surface waters, *Stream gages, *Maximum probable flood, *South Dakota, *Flood frequency, *Flood forecasting, Streamflow forecasting, Rainfall-runoff relationships.

Analyses of flood-flow frequency were made for 80 active continuous-record gaging stations and 105 discontinued crest-stage partial-record stations in South Dakota with 10 or more years of record. The analyses were developed using the log-Pearson Type III procedure recommended by the U.S. Water Resources Council (Interagency Advisory Committee on Water Data, 1981.) (USGS)
W88-03303

FLOOD OF NOVEMBER 1985 IN WEST VIRGINIA, PENNSYLVANIA, MARYLAND, AND VIRGINIA,
Geological Survey, Pittsburgh, PA. Water Resources Div.
J. B. Lescinsky.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-486, 1987. 33 p, 3 fig, 2 tab, 10 ref.

Descriptors: *Flood data, *Flood frequency, *Flood hydrographs, Surface waters, Floods, Rainfall-runoff relationships, West Virginia, Pennsylvania, Maryland, Virginia, Rainfall.

Rainfall in excess of 10 in occurred during the first 5 days of November 1985, resulting in devastating flooding in the Mid-Atlantic States of West Virginia, Pennsylvania, Maryland, and Virginia. Throughout the area, many streams exceeded previously known stages and discharges and, in many areas, the recurrence interval of peak discharges exceeded 100 years. The peak stage and discharge for the maximum previously known flood and the November 1985 flood are compared. Flood hydrographs for selected locations also are presented. (USGS)
W88-03305

TIME-OF-TRAVEL AND REAERATION DATA FOR SEVEN SMALL STREAMS IN ALABAMA, JUNE 1983 TO AUGUST 1984,
Geological Survey, Montgomery, AL. Water Resources Div.
R. A. Gardner.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-312, 1986. 17 p, 1 fig, 5 tab, 5 ref.

Descriptors: *Travel time, *Reaeration, *Streamflow tracers, *Streams, *Alabama, Tracers, Propane, Desorption.

Time-of-travel and reaeration data were collected between June 1983 and August 1984 for seven small streams in Alabama. Rhodamine WT was used as a tracer for all the studies and propane was used in the reaeration studies. Mean velocities through the study reaches ranged from 0.06 to 0.67 ft/sec. Computed reaeration coefficients, corrected to 20 C, ranged from 1.7 to 45.8 days-1. (USGS)
W88-03307

TRAVELTIME AND LONGITUDINAL DISPERSION IN ILLINOIS STREAMS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03308

WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN NEW-MEXICO--FISCAL YEAR 1986,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03309

WATER RESOURCES ACTIVITIES IN ILLINOIS, 1985,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03311

ESTIMATING AVERAGE BASE FLOW AT LOW-FLOW PARTIAL-RECORD STATIONS ON SOUTH-SHORE STREAMS OF LONG ISLAND, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03312

HYDROLOGY OF AREA 21, EASTERN COAL PROVINCE, TENNESSEE, ALABAMA, AND GEORGIA,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 4C.
W88-03315

WATER RESOURCES OF YANKTON COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03322

BENTHIC INVERTEBRATES IN SELECTED STREAMS OF THE PICEANCE CREEK BASIN, NORTHWESTERN COLORADO, WATER YEARS 1977-81,
Geological Survey, Meeker, CO. Water Resources Div.
K. J. Covay, H. E. Stranathan, and R. L. Tobin.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4138, 1985. 99 p, 13 fig, 10 tab, 30 ref.

Descriptors: *Colorado, *Benthic invertebrates, *Benthic fauna, *Biological analyses, *Piceance Creek basin, Energy, Water resources.

Data from the periodic collection of benthic invertebrates at six streamflow stations in the basin during water years 1977-81 are presented and summarized. A total of 162 genera from 8 insect orders and 8 non-insect orders were documented. Numbers of organisms per sample ranged from 0 to 3,700. Counts generally were greater during low streamflow. Diptera (two-winged flies) were the most numerous organisms and the percent composition of Diptera increased downstream. Organisms associated with both unpolluted and polluted streams were collected. The assignment of taxa into trophic groups placed most taxa into the burrowers-sprawlers-clingers (habits) groups and primary and secondary consumer (food-web) groups. General community structure, however, remained balanced and stable. Mean diversity indices ranged from 2.21 to 2.82 and similarity indices indicate better than 50% consistency of composition. Mean diversity indices were greatest in the middle part of the Piceance Creek basin. The distribution of benthic invertebrates collected indicated that no deleterious water quality conditions existed during the study period. Differences in benthos communities within and between sites are attributed to differences in water discharge, water temperature, substrate, and chemical quality of water. (USGS)
W88-03323

INVESTIGATION OF POSSIBLE EFFECTS OF SURFACE COAL MINING ON HYDROLOGY AND LANDSCAPE STABILITY IN PART OF THE POWDER RIVER STRUCTURAL BASIN, NORTHEASTERN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 4C.
W88-03325

CHANNEL-STORAGE/DISCHARGE RELATIONS FOR THE PEORIA AND LA GRANGE DAMS ON THE ILLINOIS RIVER IN ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
G. Garklavs, A. R. Klinger, and D. M. Mades.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4112, 1986. 14 p, 5 fig, 4 tab, 2 ref.

Descriptors: *Channel storage, *Flow discharge, *Illinois River, *Illinois, *Peak discharge, Dams, Streamflow.

The relations between channel storage and discharge at the Peoria and La Grange Dams on the Illinois River are defined. The relations were developed by regressing channel storage against peak discharge at the dams. Peak discharges at the Peoria Dam ranged from 19,700 to 79,500 cu ft/sec, whereas those at the La Grange Dam ranged from 27,200 to 122,000 cu ft/sec. The storage-discharge relations are linear for the range of discharges used in the analyses. For a given discharge, the channel storage upstream from the Peoria Dam is 2.4 to 4 times greater than that upstream from the La Grange Dam. (USGS)
W88-03326

HYDROLOGIC MAPS OF THE PRICE 30 X 60 MINUTE QUADRANGLE, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03328

WATER RESOURCES OF CLALLAM COUNTY, WASHINGTON: PHASE I REPORT,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03331

STREAMFLOW SIMULATION FOR THE KENTUCKY RIVER NEAR LEXINGTON AND FRANKFORT, KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
C. J. Sholar.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4052, 1986. 31 p, 19 fig, 9 tab, 5 ref.

Descriptors: *Hydrologic models, *Flow characteristics, *Streamflow, *Simulation models, *Kentucky, Potential water supply, Water use.

A streamflow-routing model was developed to simulate flows that could be used to evaluate stresses on the streamflow characteristics of the Kentucky River near Lexington and Frankfort. The study area was divided into four reaches, and

the model simulated daily streamflows at the downstream ends of each reach. Statistical analyses on the observed and simulated flows between October 1, 1940 and September 30, 1981, were compared to evaluate the model. Observed and simulated annual minimum 7-day average discharges compared satisfactorily. Frequency analyses showed the 7-day, 10-year simulated low flow values to be about 7 to 29 percent less than the observed flows. Flow duration curves showed very close comparison between observed and simulated discharges. These statistical results indicate the model was calibrated sufficiently to give reasonable simulated values. (USGS)
W88-03334

HYDRAULIC GEOMETRY AND STREAMFLOW OF CHANNELS IN THE PICEANCE BASIN, RIO BLANCO AND GARFIELD COUNTIES, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2J.
W88-03338

REAERATION COEFFICIENTS OF SIX STREAMS IN NEW YORK--A COMPARISON OF RESULTS OBTAINED BY A HYDROCARBON-GAS TRACER METHOD WITH THOSE OBTAINED BY RADIOACTIVE-TRACERS AND PREDICTIVE EQUATIONS,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03341

COST EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03342

METHODS FOR ESTIMATING LOW-FLOW STATISTICS FOR UNGAGED STREAMS IN THE LOWER HUDSON RIVER BASIN, NY,
Geological Survey, Albany, NY. Water Resources Div.
C. R. Barnes.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4070, 1986. 22 p, 5 fig, 3 tab, 41 ref.

Descriptors: *Low flow, *Regional analysis, *Base flow, *Surface-groundwater relations, *New York, *Stratified drift, Stream discharge, Glacial drift, Unconsolidated aquifers, Ungaged streams, Basin characteristics.

Seven-day, 10-year and 7-day, 2-year low flow statistics were related to selected basin characteristics by multiple-regression analysis for 53 sites with watershed areas of less than 100 sq mi in the lower Hudson River basin. A common 20-year period of record was selected to ensure comparability of results. The most significant variable was the percentage of drainage basin underlain by stratified drift. The lowest standard errors of estimate were obtained from equations giving results in terms of discharge/sq mi during low-flow conditions. The statistically significant basin characteristics needed for estimating low flow were percentage of basin containing stratified drift, mean basin elevation, and mean annual precipitation. The smallest standard errors for 7-day, 10-year and 7-day, 2-year low flows obtained were 51% of the mean and 39% of the mean, respectively. (USGS)
W88-03343

RECONNAISSANCE OF THE WATER RESOURCES AND POTENTIAL EFFECTS OF MINING OF THE JOLIET-FROMBERG COAL TRACT, CARBON COUNTY, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 4C.
W88-03345

WATER QUALITY OF STREAMS AND SPRINGS, GREEN RIVER BASIN--WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2K.
W88-03353

HYDROLOGIC DESCRIPTION OF THE TAMARACK WILDLIFE AREA AND VICINITY, LOGAN COUNTY, COLORADO, AND SIMULATED EFFECTS OF POSSIBLE WATER-MANAGEMENT ACTIVITIES,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03355

WATER-RESOURCES DATA NETWORK EVALUATION FOR MONTEREY COUNTY, CALIFORNIA--PHASE 1: SOUTH COUNTY,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03356

EFFECT OF URBANIZATION ON STREAMFLOW, SEDIMENT LOADS, AND CHANNEL MORPHOLOGY IN PHEASANT BRANCH BASIN NEAR MIDDLETON, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
W. R. Krug, and G. L. Goddard.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4068, 1986. 82 p, 38 fig, 7 tab, 19 ref.

Descriptors: *Model studies, *Channel erosion, *Sediment load, *Urban hydrology, *Rainfall-runoff relationships, *Storm runoff, Channel morphology, Computer models, Urbanization, Stream gradient, Pheasant Branch, Middleton, Distributed-Routing Rainfall-Runoff Model, Channel charges, Channel surveys, Hydrograph simulation, Wisconsin.

A 5-year, data collection and modeling study was conducted on Pheasant Branch basin in and near Middleton, Wisconsin. The objectives of the study were (1) to describe the streamflow characteristics, sediment transport, and stream channel morphology in the Pheasant Branch basin and (2) to relate the above factors to changes caused by urbanization and project the effect that urbanization will have on the hydrology and channel morphology of the study area. Suspended-sediment yields from the South Fork basin were the highest of all basins monitored. A comparison of storm suspended sediment loads between Century Avenue and the mouth indicated deposition of about 4,000 tons of sediment in the marsh between the two sites. Downstream from the fully urbanized part of the basin, the mean streambed elevation was lowered by almost 2 ft between 1971 and 1977, while the mean channel width increased by more than 35%. In other reaches of the stream, the mean streambed elevation was lowered by more than 1 foot. A rainfall-runoff model was used to simulate 68 years of summer flood hydrographs for (1) current land use, (2) projected urban development, and (3) complete urban development. The simulated mean annual flood peaks at U.S. Highway 12 would be increased by factors of 2.0 and 2.4 by projected and complete urban development, respectively. This would cause the channel width to increase by 40 to 50% and the channel depth to increase by 30 to 40%. (USGS)
W88-03357

TRAVELTIME AND DISPERSION OF A SOLUBLE DYE IN THE SOUTH BRANCH POTOMAC RIVER, WEST VIRGINIA,
Geological Survey, Charleston, WV. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03362

INDEX OF CURRENT WATER-RESOURCES ACTIVITIES IN OHIO, 1985,
Geological Survey, Columbus, OH. Water Resources Div.
M. Eberle.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-555, 1985. 59 p, 2 fig, 174 ref.

Descriptors: *Hydrologic data collections, *Surface waters, *Groundwater, *Ohio, Data aquisition, Groundwater levels.

This report summarizes the U. S. Geological Survey's Water Resources Division's program in Ohio in 1985. The work of the Ohio District is carried out through the District office in Columbus and a field office in New Philadelphia. Collection of basic data needed for continuing determination and evaluation of the quantity, quality, and use of Ohio's water resources is the responsibility of the District's Hydrologic Surveillance Section. The Hydrologic Investigations Section conducts analytical and interpretive water-resource appraisals describing the occurrence, availability, and the physical, chemical, and biological characteristics of surface and groundwater. In addition to introductory material describing the structure of the Ohio District, information is presented on current projects, sites at which basic surface- and groundwater data are collected, and reports of Ohio's water resources published by the U.S. Geological Survey and cooperating agencies. (USGS)
W88-03365

WATER-RESOURCES ACTIVITIES IN UTAH BY THE U.S. GEOLOGICAL SURVEY, JULY 1, 1984 TO JUNE 30, 1985,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03375

PRELIMINARY EVALUATION OF REGRESSION EQUATIONS FOR PREDICTING MAGNITUDE AND FREQUENCY OF FLOOD PEAKS IN SELECTED SMALL DRAINAGE BASINS IN OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
J. R. Kolva.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-194, 1985. 30 p, 13 fig, 3 tab, 16 ref.

Descriptors: *Flood peak, *Small watersheds, *Regression analysis, *Ohio, Agricultural watersheds, Forest watersheds, Strip mines, Peak flow.

Published regionalized flood equations may not be adequate for predicting peak flows in small basins that are heavily forested, surface mined, or in northwestern Ohio. In order to provide a larger data base for improving estimation of flood peaks in these basins, 30 crest-stage gages were installed in 1977 to provide 10 years of flood data. Annual peaks were recorded or estimated for all 30 sites for the water years 1978-82; an additional year of peak discharges was available at four sites. The observed 2-year (Q2) and 5-year (Q5) flood peaks were determined by graphical methods, and 'predicted' Q2 and Q5 values were calculated using regionalized regression equations. The ratios of the observed to predicted 2-year (R2) and 5-year (R5) values were then calculated. The observed peaks are lower than predicted peaks by a significant amount in surface-mined basins. Predicted peaks from forested agree with the observed values fairly well. Predicted peaks are lower than the observed peaks in the northwestern Ohio sites. Some preliminary regression analyses indicate that revisions and flood-prediction equations described in this report might be appropriate after a longer period of data collection. (USGS)
W88-03380

BASE FLOW MEASUREMENTS AT PARTIAL-RECORD SITES ON SMALL STREAMS IN SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.

A. C. Barker.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-143, 1986. 97 p, 2 fig, 1 tab, 3 ref.

Descriptors: *Base flow, *Stream discharge, *Streamflow, *Data collections, *Discharge measurements, *South Carolina, *Headwater streams, Streams, Blue Ridge province, Piedmont province, Upper Coastal Plain province, Climatic year.

This report contains site descriptions and base-flow data collected at 362 partial-record sites in South Carolina. These data include site name, site description, latitude, longitude, drainage area, instantaneous streamflow, and date of the streamflow measurement. The base-flow data can be used as an aid to estimate low flow characteristics at ungaged locations on streams in South Carolina. Partial record data collection sites were established in all physiographic provinces except the lower Coastal Plain. Data collection sites were not established in the lower Coastal Plain because of the widespread occurrence of zero during drought periods in all but the larger streams. (USGS)
W88-03389

FLOODS OF JUNE-JULY 1982, IN IOWA,
Geological Survey, Iowa City, IA. Water Resources Div.
A. J. Heinitz.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-151, 1986. 18 p, 6 fig, 1 tab, 4 ref.

Descriptors: *Floods, *Iowa, *Surface runoff, *Historic floods, Regional floods, River flow, Hydrology, Water resources development, Flooding, Rainfall, Indian Creek, Cedar Creek, Highwater marks.

Record flood-peak discharges in June and July, 1982, in southwestern, south-central and east-central Iowa resulted from rainstorms with officially recorded amounts of 6 to 8 inches of rain on soil saturated from persistent moderate to heavy rainfalls that began in May and continued through mid-July. May was the wettest across Iowa since 1959, averaging just over 7 inches statewide to rank as Iowa's 6th wettest May in 100 years of State records. Statewide rainfall for July averaged in excess of 6 inches to rank among the 3rd wettest July in Iowa since 1958. One of the greatest floods ever recorded in the State occurred on Cedar Creek in south-central Iowa on July 3, 1982. The flood peak discharge at the gaging station near Bussey (05489000) was 4.4 times that of a regional 100-year flood. The gage height exceeded the record flood stage of July 4, 1981, by 5.78 ft. (USGS)
W88-03390

FLOODS IN THE FLOYD RIVER BASIN, IOWA,
Geological Survey, Iowa City, IA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W88-03391

CHANNEL GEOMETRY AND HYDROLOGIC DATA FOR SIX ERUPTION-AFFECTED TRIBUTARIES OF THE LEWIS RIVER, MOUNT ST. HELENS, WASHINGTON, WATER YEARS 1983-84,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 2J.
W88-03401

STORAGE AND RELEASE OF WATER IN A LARGE GLACIER-DAMMED LAKE: RUSSELL LAKE NEAR YAKUTAT, ALASKA, 1986,
Geological Survey, Juneau, AK. Water Resources Div.
For primary bibliographic entry see Field 2C.
W88-03410

EVALUATION OF THE PRECIPITATION-RUNOFF MODELING SYSTEM, BEAVER CREEK, KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
D. E. Bower.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4316, 1985. 39 p, 12 fig, 24 tab, 15 ref.

Descriptors: *Coal mining, *Computer models, *Hydrologic models, *Model testing, *Kentucky, Hydrology, Mine drainage, Model studies, Rainfall-runoff relations, Sediment load, Sediment yield, Surface runoff, Appalachian coal region, Beaver Creek basin, Coal hydrology, PRMS model, Surface mining hydrology.

The Precipitation Runoff Modeling System (PRMS) was evaluated with data from Cane branch and Helton Branch in the Beaver Creek basin of Kentucky. Because of previous studies, 10.6 years of record were available to establish a data base for the basin including 60 storms for Cane Branch and 50 storms for Helton Branch. The model was calibrated initially using data from the 1956-58 water years. Runoff predicted by the model was 94.7% of the observed runoff at Cane Branch (mined area) and 96.9% at Helton Branch (unmined area). After the model and data base were modified, the model was refitted to the 1956-58 data for Helton Branch. It then predicted 98.6% of the runoff for the 10.6-year period. The model parameters from Helton Branch were then used to simulate the Cane Branch runoff and discharge. The model predicted 102.6% of the observed runoff at Cane Branch for the 10.6 years. The simulations produced reasonable storm volumes and peak discharges. Sensitivity analysis of model parameters indicated the parameters associated with soil moisture are the most sensitive. The model was used to predict sediment concentration and daily sediment load for selected storm periods. The sediment computations indicated the model can be used to predict sediment concentrations during storm events. (USGS)
W88-03422

FLOOD OF SEPTEMBER 12-13, 1982 IN GIBSON, CARROLL, AND MADISON COUNTIES, WEST TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
C. H. Robbins, C. R. Gamble, and R. H. Bingham.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4037, 1986. 1 sheet (map), 12 fig, 2 tab, 5 ref.

Descriptors: *Floods, *Flood frequency, *Peak discharge, *Tennessee, Precipitation, Runoff, Historic flood, Recurrence interval.

Intense rainfall on September 12-13, 1982, caused severe local flooding along many streams in Gibson County in western Tennessee. The rainfall resulted from remnants of Hurricane Chris combining with a cool front moving across the western half of the State. A maximum 1-hr rainfall intensity of 3.3 in was recorded at Humboldt. Peak discharge exceeded the 100-yr flood on many small streams. The floods caused three deaths and about 15.3 million dollars damage to crops, roads and bridges, businesses, and residential areas. Long-time residents of Gibson County reported that stream stages have not been as high since at least 1922. (USGS)
W88-03423

EVALUATION OF THE U.S. GEOLOGICAL SURVEY'S GAGING-STATION NETWORK IN ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03429

FLOODFLOW CHARACTERISTICS OF CURRENT RIVER AT ARKANSAS STATE HIGHWAY 328 NEAR REYNO, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
R. C. Gilstrap, and B. L. Neely.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4061, 1986. 15 p, 6 fig, 2 tab, 1 ref.

Descriptors: *Flood profiles, *Discharge, *Arkansas, *Flood data, Frequency, Elevations, Highway construction, Reyno.

Arkansas State Highway 328 in Randolph County crosses Current River about 1.5 mi northwest of Reyno, Arkansas. A main channel bridge with a relief bridge on each side, five culverts, and a bridge on the west side of the valley were the existing flow structures prior to a December 1982 flood. After the December 1982 flood, 34 additional culverts were installed along the highway. The flood of December 3, 1982, which had a computed peak discharge of 85,300 cu ft/sec and a recurrence interval of about 8 years, caused considerable damage to the highway being reconstructed. The flood of April 1985, which had a discharge of 48,000 cu ft/sec and a recurrence interval of about 2 years, also caused damage to fill areas of the reconstructed highway. A hydraulic analysis was conducted for the 5-, 10-, 25-, 50- and 100-year flood and the floods of December 1982 and April 1985 to determine the river stages before and after Highway 328 was reconstructed. Results of the study indicate that the water surface along the upstream water surface elevations less than 0.1 ft. (USGS)
W88-03438

HYDROLOGY OF THE LAKE MIONA AREA, NORTHEAST SUMTER COUNTY, FLORIDA,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 2H.
W88-03439

VARIABILITY IN BASE STREAMFLOW AND WATER QUALITY OF STREAMS AND SPRINGS IN OTTER AND ROSEBUD CREEK BASINS, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
J. H. Lambing, and R. F. Ferreira.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4302, 1986. 49 p, 14 fig, 10 tab, 9 ref.

Descriptors: *Base flow, *Springs, *Water quality, *Montana, Dissolved solids, Otter Creek, Rosebud Creek.

The results of three base-flow studies conducted on Otter and Rosebud Creeks during 1977, 1978, and 1983 are summarized and compared to assess the variability of base-flow magnitude and water quality during years of widely different precipitation. Chemical analyses for springs in these basins also are presented to provide and indication of the areal and temporal variability of groundwater quality. Base-flow magnitudes in Otter and Rosebud Creeks vary considerably in response to precipitation of the previous year. Maximum observed differences in base-flow magnitudes between the study years were 3.8 cu ft/sec in Otter Creek and 53 cu ft/sec in Rosebud Creek. Predominant ions of base streamflow are sodium, magnesium, and sulfate in Otter Creek and magnesium, calcium, sodium, sulfate, and bicarbonate in Rosebud Creek. Dissolved solids concentrations varied considerably, with maximum differences between study years of about 1,200 mg/L in Otter Creek and about 3,200 mg/L in Rosebud Creek. The ionic composition of springs in the Otter and Rosebud Creek basins is generally similar to that of the streams. Dissolved solids concentrations of the springs vary largely throughout each basin; however, there was little variability between sampling years at individual springs. (USGS)
W88-03440

RECONNAISSANCE OF THE WATER RESOURCES OF THE HOH INDIAN RESERVA-

TION AND THE HOH RIVER BASIN, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
W. E. Lum.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4018, 1986. 56 p, 9 fig, 8 tab, 12 ref.

Descriptors: *Water supply, *Soil absorption capacity, *Water quality, *Fluvial sediments, *Washington, Water resources data, Groundwater recharge, Indian reservations, Hoh River basin.

Ground- and surface-water resources of the Hoh Indian Reservation and the Hoh River basin were studied from 1977 to 1980 under a cooperative agreement between the U.S. Geological Survey and the Hoh Indian Tribe. It was determined that moderate quantities of groundwater can be obtained from near-surface, river-deposited sands and gravels on the northeastern part of the reservation. Groundwater recharge (induced by pumping from a nearby oxbow lake) could supply numerous wells indefinitely with yields of 25 to 50 gallons/min. Geologic units in other areas of the reservation appear to have a low hydraulic conductivity and would yield little, if any, water to wells. At seven sites where housing construction is planned, soils were tested for infiltration rates and it was determined that soils are adequate for waste disposal in septic tanks and associated drain fields at those locations. Chalaat Creek, which flows across the reservation, provides water for salmon-rearing ponds. Except for moderately high bacteria concentrations (fecal coliform bacteria concentrations were as high as 33 colonies/100 mL), results of water quality analyses indicate no unusual or harmful concentrations of any chemical constituent or physical properties of the water that would restrict its use for most purposes. Chemical and bacteriological analyses of the Hoh River and its major tributaries downstream from the Olympic Park boundary revealed no unusual or harmful levels of constituents, with some minor exceptions. Small increases in concentrations of sodium, chloride, nitrite plus nitrate, and turbidity were measured in water samples collected from the Hoh River in a downstream direction. These increases are probably the result of natural weathering of rocks and soils in the basin. Fluvial-sediment transport of the Hoh River was 82,000 tons from March 1978 to February 1979 and 1,510,000 tons from March 1979 to February 1980. Mean annual transport was estimated to be 630,000 tons. About 60% of the sediment transported by the Hoh River originates from within the boundaries of the Olympic National Park, which includes about 70% of the area of the Hoh River drainage basin. (USGS)
W88-03441

SIMULATED FLOOD DISCHARGES AND ELEVATIONS FOR THE SAVANNAH RIVER, SOUTH CAROLINA AND GEORGIA, USING AN UNSTEADY STREAMFLOW MODEL,
Geological Survey, Columbia, SC. Water Resources Div.
B. B. McDonald.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Research Institute, Publication No. 121, Clemson Univ., S.C. August 1986. 83 p, 36 fig, 3 tab, 36 ref.

Descriptors: *Annual floods, *Computer models, *Flood hydrographs, *Flood profiles, *Frequency analysis, *Stage-discharge relations, *Simulated streamflow, *Savannah River, Calibrations, Boundary conditions, Continuity equation, Discharge hydrographs, Finite difference methods, Gaging stations, Momentum equation, Courant equation, Cross-sectional analysis, Lateral inflow, South Carolina, Georgia.

A linear implicit finite-difference model that uses the continuity and momentum equations was used to simulate unsteady streamflow along a 126-mile reach of the Savannah River. Streamflow records from the gaging stations at Augusta, Georgia, the upstream boundary, and Clyo, Georgia, the downstream boundary, for the years 1952-79, were used as input data. Data from the stream gage at Millhaven, 74 miles downstream from Augusta, along with discharge data from the stream gage at Clyo, were used to calibrate and verify the accuracy of the model. Maximum annual flood discharges and elevations for intermediate locations along the reach were computed by the model. Simulated annual peak discharge data were used in a frequency analysis to obtain the 10-, 50-, 100-, and 500-year flood profiles. (USGS)
W88-03443

DETERMINATION OF ROUGHNESS COEFFICIENTS FOR STREAMS IN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
R. D. Jarrett.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4004, 1985. 54 p, 14 fig, 7 tab, 28 ref.

Descriptors: *Flow resistance, *Hydraulic roughness, *Values, *Roughness coefficient, *Colorado, Channels, Floods, Froude number, Open channels, Open-channel flow.

Most hydraulic calculations of flow in channels and overbank areas require an evaluation of flow resistance, generally expressed as Manning's roughness coefficient. The degree of roughness depends on many factors. The report summarizes and relates several methods of estimating roughness and presents additional channel-roughness verification data on higher-gradient streams with slopes greater than 0.002. A procedure is outlined that enables the user to systematically evaluate the factors affecting natural, agricultural, and urban channel and overbank roughness. Two prediction equations are presented to aid in the calculation of coefficients for natural stable channels in which roughness changes dramatically with depth of flow. Roughness coefficients can be determined from low-to-high flow conditions as long as the channel remains fairly stable, sediment concentrations are not so great as to result in mudflows or debris flows, and stream slopes are less than 0.05. Because of extreme turbulence, large energy losses, and hence large roughness coefficients, flow in high-gradient, cobble- and boulder-bed mountain streams generally is subcritical. (USGS)
W88-03463

LOW FLOWS AND FLOW DURATION OF TENNESSEE STREAMS THROUGH 1981,
Geological Survey, Nashville, TN. Water Resources Div.
R. H. Bingham.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4347, 1985. 325 p, 6 fig, 2 tab, 6 ref.

Descriptors: *Low flow, *Flow duration, *Streamflow, *Tennessee, *Recurrence, Gaging stations, Hydrologic data.

Estimates of low-flow characteristics and flow duration for the period of record at continuous-record streamflow gages are essential in hydrologic studies and water-resources management. This report provides estimates of low flow for 1, 3, 7, 14, 30, 60, and 90 consecutive days for recurrence intervals of 2, 5, 10, and 20 years for continuous-record streamflow gages in Tennessee. These estimates were used in correlation methods to estimate low flow at partial-record streamflow sites for 1, 3, and 7 consecutive days for a recurrence interval of 10 years; and 3 consecutive days for a recurrence interval of 20 years. (USGS)
W88-03471

CHEMICAL AND ECOLOGICAL EFFECTS OF A PENNINE PEAT-SLIDE,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
For primary bibliographic entry see Field 2H.
W88-03481

FATE OF METAL CONTAMINATED SEDIMENTS IN FOUNDRY COVE, NEW YORK,
State Univ. of New York at Stony Brook. Dept. of Ecology and Evolution.
For primary bibliographic entry see Field 5B.
W88-03482

2F. Groundwater

GROUND WATER QUALITY.
For primary bibliographic entry see Field 5G.
W88-02533

CALMING THE RESTLESS NATIVE: HOW GROUND WATER QUALITY WILL ULTIMATELY ANSWER THE QUESTIONS OF GROUND WATER POLLUTION,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5G.
W88-02534

OVERVIEW OF CONTAMINANTS IN GROUND WATER,
Rijksinstituut voor de Volksgezondheid en Milieuhygiene, Leidschendam (Netherlands).
For primary bibliographic entry see Field 5B.
W88-02535

CHEMICAL CONTAMINATION OF GROUND WATER,
Geraghty and Miller, Inc., Syosset, NY.
For primary bibliographic entry see Field 5B.
W88-02536

MICROBIAL CONTAMINATION OF THE SUBSURFACE,
Arizona Univ., Tucson. Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W88-02537

EFFECTS OF LOCAL SOURCES OF POLLUTION ON GROUND WATER QUALITY IN THE NETHERLANDS,
Rijksinstituut voor de Volksgezondheid en Milieuhygiene, Leidschendam (Netherlands).
For primary bibliographic entry see Field 5B.
W88-02538

REDOX REACTIONS, MINERAL EQUILIBRIA, AND GROUND WATER QUALITY IN NEW ZEALAND AQUIFERS,
Department of Scientific and Industrial Research, Petone (New Zealand). Chemistry Div.
For primary bibliographic entry see Field 5B.
W88-02539

BEHAVIOR OF ORGANIC POLLUTANTS IN PRETREATED RHINE WATER DURING DUNE INFILTRATION,
Rijksinstituut voor de Volksgezondheid en Milieuhygiene, Leidschendam (Netherlands).
For primary bibliographic entry see Field 5B.
W88-02540

EFFECTS OF DISCHARGING A PRIMARY SEWAGE EFFLUENT ON THE TRIASSIC SANDSTONE AQUIFER AT A SITE IN THE ENGLISH WEST MIDLANDS,
Water Research Centre, Medmenham (England). Medmenham Lab.
For primary bibliographic entry see Field 5B.
W88-02541

LAND APPLICATION OF MUNICIPAL WASTE WATER,
National Center for Ground Water Research, Norman, OK.
For primary bibliographic entry see Field 5E.
W88-02542

OVERVIEW OF METHODS FOR GROUND WATER INVESTIGATIONS,
Water Research Centre, Medmenham (England). Medmenham Lab.

C. P. Young, and K. M. Baxter.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 219-240, 9 fig, 2 tab, 26 ref.

Descriptors: *Groundwater quality, *Water sampling, Geohydrology, Borehole drilling, Tracers, Groundwater movement, Porosity, Groundwater.

A wide range of investigating techniques have been developed to suit the predominant hydrogeological conditions present in the United Kingdom. The high capital costs of borehole drilling have encouraged the development of more sophisticated sampling methods and of the increased use of repeatable, geophysical borehole logging techniques. The use of artificial tracers in groundwater studies is increasing and promises to be a useful tool in elucidating the groundwater flow relationships in dual porosity (matrix vs. fractures) media. (See also W88-02533) (Lantz-PTT)
W88-02543

BIOCHEMICAL METHODS FOR DETECTION OF SUBSURFACE CONTAMINATION/BIOMASS,
Oklahoma State Univ., Stillwater. Dept. of Biochemistry.
For primary bibliographic entry see Field 5A.
W88-02544

METHODS FOR THE ASSESSMENT OF GROUND WATER POLLUTION POTENTIAL,
National Center for Ground Water Research, Norman, OK.
For primary bibliographic entry see Field 7A.
W88-02545

BIOCHEMICAL MEASURES OF THE BIOMASS, COMMUNITY STRUCTURE, AND METABOLIC ACTIVITY OF THE GROUND WATER MICROBIOTA,
Florida State Univ., Tallahassee. Dept. of Biological Science.
D. C. White, J. S. Nickels, J. H. Parker, R. H. Findlay, and M. J. Gehron.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 307-329, 3 fig, 3 tab, 53 ref. Dept. of Navy Contract No. N00014-75-C-0201.

Descriptors: *Groundwater, *Microbiological studies, *Biomass, *Metabolism, *Biochemical analysis, Chemical analysis, Biological studies, Groundwater quality, Bacteria, Lipids, Algae, Fungi, Protozoa, Microorganisms.

Experiments based on one site and two samplings of contaminated groundwater lead to these conclusions. (1) The microbiota in the groundwater sediments is sparse compared to the surface microbiota by four measures of microbial biomass; (2) This microbiota is clearly different by a number of criteria from the surface microbiota. There is a large proportion of gram-positive bacteria. The microbiota is greatly enriched in sulfate reducing and fermentative bacteria that contain different lipid 'fingerprints' compared to the microbiota found at the surface or deep sea; (3) There is an absence of microeukaryotes such as algae, fungi, protozoa, and micrometazoa in the groundwater microbiota; (4) The microbiota of the groundwater system exists under conditions of unbalanced growth in which the cells are metabolizing but not dividing. This is reflected in the 20-fold higher content of PHB/cell and the large amount of uronic acid-rich extracellular polysaccharide glycocalyx seen in the electron microscope. These microbes not only constitute a different community but exist in different metabolic status; (5) Methods exist or can be readily adapted by which the activity of this unique bacterial community can be correlated to its distinctive biodegradative activities. This will be essential in the management decisions necessary to protect the water resource. Groundwater aquifer sediments from 410 m below the surface were analyzed with these methods and quite similar microbiota was detected. (See also W88-02533) (Lantz-PTT)
W88-02546

MICROCOSM FOR GROUND WATER RESEARCH,
National Center for Ground Water Research, Norman, OK.
For primary bibliographic entry see Field 5B.
W88-02547

SUBSURFACE CHARACTERIZATION IN RELATION TO GROUND WATER POLLUTION,
Water Research Centre, Medmenham (England). Medmenham Lab.
For primary bibliographic entry see Field 5B.
W88-02548

STRATEGY FOR SUBSURFACE CHARACTERIZATION RESEARCH,
Oklahoma State Univ., Stillwater. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W88-02549

INTERACTION BETWEEN ORGANIC MOLECULES AND MINERAL SURFACES,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 5B.
W88-02550

MICROBIOLOGICAL CHARACTERIZATION OF SUBSURFACE ENVIRONMENTS,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 5A.
W88-02551

REGIONAL APPROACH TO GROUND WATER INVESTIGATIONS,
Oklahoma State Univ., Stillwater.
W. A. Pettyjohn.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 402-417, 7 fig, 7 ref.

Descriptors: *Groundwater movement, *Groundwater budget, *Regional analysis, Geohydrology, Remote sensing, Stream hydrographs, Hydrographs, Mathematical studies, Graphical analysis, Flow profiles, Seepage.

Commonly a research plan is not formulated prior to the initiation of hydrogeological field studies. Such a plan, if based on sound hydrogeologic principles, should lead the investigator down a logical path toward a solution that minimizes costs and maximizes efficiency. Generally hydrogeologists depend on the very expensive and locally seasonal process of drilling test holes and wells to obtain basic data. Such drilling is usually essential, but a variety of techniques are available to asses hydrogeologic conditions from a regional perspective that can substantially reduce field costs. Remote sensing and stream hydrographs are two such methods, as well as the calculation of flow-duration curves, flow ratios, and the measurement of seepage or dry-weather values. Generally, this data is needed for regional studies and can be easily and inexpensively obtained. (See also W88-02533) (Lantz-PTT)
W88-02552

ADVECTION-DISPERSION-SORPTION MODELS FOR SIMULATING THE TRANSPORT OF ORGANIC CONTAMINANTS,
Stanford Univ., CA. Terman Engineering Center.
For primary bibliographic entry see Field 5B.
W88-02553

BEHAVIOR AND FATE OF HALOGENATED HYDROCARBONS IN GROUND WATER,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
For primary bibliographic entry see Field 5B.
W88-02554

SURVIVAL AND TRANSPORT OF PATHOGENIC BACTERIA AND VIRUSES IN GROUND WATER,
Kiel Univ. (Germany, F.R.). Geologisch-Palaeontologisches Inst. und Museum.
For primary bibliographic entry see Field 5B.
W88-02555

BIODEGRADATION OF CONTAMINANTS IN THE SUBSURFACE,
Robert S. Kerr Environmental Research Lab., Ada, OK.
For primary bibliographic entry see Field 5B.
W88-02556

ANAEROBIC TRANSFORMATION, TRANSPORT, AND REMOVAL OF VOLATILE CHLORINATED ORGANICS IN GROUND WATER,
Florida International Univ., Miami. School of Technology.
For primary bibliographic entry see Field 5B.
W88-02557

BASIC CONCEPTS FOR GROUND WATER TRANSPORT MODELING,
National Center for Ground Water Research, Norman, OK.
For primary bibliographic entry see Field 5B.
W88-02558

GROUNDWATER CONTAMINATION.
National Research Council, Washington, DC.
For primary bibliographic entry see Field 5E.
W88-02602

EXTENT OF GROUNDWATER CONTAMINATION IN THE UNITED STATES,
Academy of Natural Sciences of Philadelphia, PA.
For primary bibliographic entry see Field 5B.
W88-02603

MOVEMENT OF CONTAMINANTS IN GROUNDWATER: GROUNDWATER TRANSPORT - ADVECTION AND DISPERSION,
Wisconsin Univ.-Madison.
For primary bibliographic entry see Field 5B.
W88-02604

CONTAMINANTS IN GROUNDWATER: CHEMICAL PROCESSES,
Waterloo Univ. (Ontario).
For primary bibliographic entry see Field 5B.
W88-02605

SHALLOW LAND BURIAL OF MUNICIPAL WASTES,
Illinois State Geological Survey Div., Champaign.
For primary bibliographic entry see Field 5E.
W88-02606

DEEP BURIAL OF TOXIC WASTES,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 5E.
W88-02607

GROUNDWATER CONTAMINATION AND AQUIFER RECLAMATION AT THE ROCKY MOUNTAIN ARSENAL, COLORADO,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 5B.
W88-02608

GEOLOGIC PROBLEMS AT LOW-LEVEL RADIOACTIVE WASTE-DISPOSAL SITES,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 5E.
W88-02609

GROUNDWATER FLOW MODELING STUDY OF THE LOVE CANAL AREA, NEW YORK,
GeoTrans, Inc., Reston, VA.
J. W. Mercer, C. R. Faust, and L. R. Silka.

Groundwater Contamination, National Academy Press, Washington, DC. February 1984. p 109-119, 6 fig, 3 tab, 20 ref. EPA Subcontract No. 1-619-026-222-003D. EPA Contract No. 68-02-3168.

Descriptors: *Hazardous wastes, *Model studies, *Love Canal, *New York, *Groundwater movement, *Groundwater pollution, *Hydrologic models, *Aquifer testing, *Path of pollutants, Water pollution sources, Landfills, Leaching, Leachates, Hazardous materials.

Increasing awareness of the problems presented by hazardous waste sites is leading toward an increased interest in, and application of, groundwater models. During the fall of 1980, a groundwater modeling study was conducted at the Love Canal area, Niagara Falls, New York. Flow models were used to aid in data reduction and analysis and to attempt prediction of groundwater movement. Both slug tests and aquifer tests were analyzed. The conceptual framework for the hydrogeologic units underlying Love Canal consists of a shallow water-table system of silts and fine sands and a deeper confined system in the Lockport Dolomite. The intervening confining layers consist of lacustrine and glacial clays. Modeling in the dolomite focused on characterizing the aquifer and assessing the potential for its contamination. Best judgement indicates that for the Lockport to be contaminated, the confining bed would have to be breached. Analysis of remedial action for the Lockport Dolomite indicates that three interceptor wells at the south end of the canal, pumped at only 32.3 cu m/day, would reverse the flow of groundwater to the river and provide an adequate halt to migration of potential contaminants to the river. (See also W88-02602) (Author's abstract)
W88-02610

NONPOINT CONTAMINATION OF GROUNDWATER ON LONG ISLAND, NEW YORK,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 5B.
W88-02611

HYDROGEOCHEMICAL STUDIES AT A LANDFILL IN DELAWARE,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 5B.
W88-02612

ASSESSMENT OF THE POTENTIAL FOR RADIONUCLIDE MIGRATION FROM A NUCLEAR EXPLOSION CAVITY,
Los Alamos National Lab., NM.
For primary bibliographic entry see Field 5B.
W88-02613

GROUNDWATER RESTORATION WITH IN SITU URANIUM LEACH MINING,
Texas Univ. at Austin.
For primary bibliographic entry see Field 5G.
W88-02614

SELECTED VARIABLES AFFECTING THE CHOICE BETWEEN FEDERAL AND STATE REGULATORY RESPONSIBILITY: GROUNDWATER QUALITY AS AN ILLUSTRATIVE CASE,
Utah State Univ., Logan.
For primary bibliographic entry see Field 6E.
W88-02615

RISK ASSESSMENT FOR THE PREVENTION OF GROUNDWATER CONTAMINATION,
Case Western Reserve Univ., Cleveland, OH.
Y. Y. Haimes.
Groundwater Contamination, National Academy Press, Washington, DC. February 1984. p 166-179, 3 fig, 52 ref. NSF Grant No. ENG-79-03605 and DOE Grant No. DEACO-180-RA050256.

Descriptors: *Groundwater pollution, *Water law, *Water pollution prevention, *Risks, *Groundwater management, Public policy, Water quality control, Water policy, Economic aspects, Evaluation, Cost-benefit analysis.

Groundwater, which is a major source of water supply in the United States is facing severe quantity and quality problems. Once contaminated, the options available for its use are both limited and costly. The immense risks and costs to the public associated with groundwater contamination necessitate the formulation of public policy that is conducive to the prevention of this contamination. This chapter addresses the prevention of groundwater contamination through the use of risk assessment, which embraces both the determination of costs, benefits, and levels of risks and the process of their social evaluation. Since the U. S. Environmental Protection Agency (EPA), mandated by present laws, will eventually promulgate national effluent guidelines that should be scientifically and technologically sound, economically efficient, and socially equitable, the adoption of risk assessment for this purpose seems imperative. Several recently developed risk-assessment methodologies that integrate multiobjective trade-off analysis are evaluated in terms of their effective use in the formulation of public policies leading to the prevention of groundwater contamination. Two risk-assessment methodologies - the multiobjective statistical method (MSM) and the partitioned multiobjective risk method (PMRM) - are also evaluated in terms of their specific usefulness to the EPA's ongoing effort in promulgating national effluent guidelines to limit toxic pollutants. Finally, the applicability of 'economic incentives' discussed in the report by the NRC Committee on Ground Water Resources in Relation to Coal Mining (1981) is also evaluated within the framework of risk assessment. (See also W88-02602) (Author's abstract)
W88-02616

ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES,
Texas A and M Univ., College Station. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W88-02766

APPLICATION OF THE TRITIUM INTERFACE METHOD FOR DETERMINING RECHARGE RATES TO UNCONFINED DRIFT AQUIFERS: I. HOMOGENEOUS CASE,
Michigan State Univ., East Lansing. Dept. of Geological Sciences.
G. J. Larson, M. R. Delcore, and S. Offer.
Journal of Hydrology JHYDA7, Vol. 91, No. 1/2, p 59-72, May 15, 1987. 6 fig, 1 tab, 57 ref. Geological Society of America Grant 2890-81.

Descriptors: *Groundwater recharge, *Tritium interface method, *Aquifers, *Glacial aquifers, *Tracers, *Infiltration, *Tritium, *Groundwater, Aquifer characteristics, Aquifer testing, Saturation zone, Homogeneity, Cape Cod, Massachusetts, Groundwater movement, Water table, Hydrologic budget.

The depth of penetration of bomb tritium into the saturated zone was used to calculate the rate of groundwater recharge to an unconfined homogeneous drift aquifer in Cape Cod, Massachusetts (U.S.A.). The aquifer is of glaciofluvial origin and is composed of well sorted sand and gravel. Tritium concentration in groundwater ranged from 0 to 85 T.U. Bomb tritium (> 5 T.U.) was found in 45 groundwater samples collected from 1.5 to 27.1 m below the water table; prebomb tritium concentrations (< 5 T.U.) were identified in 4 samples collected from 25.6 to 41.1 m below the water table. Assuming piston-type flow beneath groundwater divides, the rate of recharge to the aquifer was found to range from 33.7 to 40.6 cm/year. This range agrees favorably with recharge estimates previously determined from water budget analysis. (See also W88-02768) (Author's abstract)
W88-02767

APPLICATION OF THE TRITIUM INTERFACE METHOD FOR DETERMINING RECHARGE RATES TO UNCONFINED DRIFT AQUIFERS: II. NON-HOMOGENEOUS CASE,
Michigan State Univ., East Lansing. Dept. of Geological Sciences.
M. R. Delcore, and G. J. Larson.
Journal of Hydrology JHYDA7, Vol. 91, No. 1/2, p 73-81, May 15, 1987. 5 fig, 31 ref.

Descriptors: *Groundwater recharge, *Tritium interface method, *Aquifers, *Glacial aquifers, *Tracers, *Infiltration, *Groundwater movement, *Tritium, *Groundwater, Aquifer characteristics, Aquifer testing, Saturation zone, Nonhomogeneity, Michigan, Water table, Hydrologic budget.

The depth of penetration of bomb tritium into the saturated zone was used to calculate the rate of groundwater recharge to an unconfined non-homogeneous drift aquifer in southwestern Michigan (U.S.A.). The aquifer is of glaciofluvial origin and is composed of sand and gravel and interstratified lenses of silt. Bomb tritium (>5 T.U.) was found in 40 groundwater samples, collected from 1.7 to 29.6 m below the water table; prebomb tritium (<5 T.U.) was identified in 5 samples collected from 21.3 to 33.2 m below the water table. Assuming piston-type flow beneath groundwater divides, the rate of recharge to the aquifer was found to range from 17.6 to 35.1 cm/year. This range agrees favorably with recharge estimates previously determined from water budget analysis. (See also W88-02767) (Author's abstract)
W88-02768

COMPARING A THREE-DIMENSIONAL AND A DUPUIT-FORCHHEIMER SOLUTION FOR A CIRCULAR RECHARGE AREA IN A CONFINED AQUIFER,
Indiana Univ., Bloomington. School of Public and Environmental Affairs.
For primary bibliographic entry see Field 5B.
W88-02769

NOTE ON THE ANALYSIS OF SLUG TESTS,
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.
For primary bibliographic entry see Field 7C.
W88-02773

STOCHASTIC MODELING OF VERTICALLY AVERAGED CONCENTRATION UNCERTAINTY IN A PERFECTLY STRATIFIED AQUIFER,
Stanford Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W88-02777

GROUNDWATER GEOCHEMISTRY OF SHORT-TERM AQUIFER THERMAL ENERGY STORAGE TEST CYCLES,
Illinois State Water Survey Div., Champaign.
T. R. Holm, S. J. Eisenreich, H. L. Rosenberg, and N. P. Holm.
Water Resources Research WRERAQ, Vol. 23, No. 6, p 1005-1019, June 1987. 9 fig, 12 tab, 69 ref.

Descriptors: *Groundwater geochemistry, *Aquifers, *Thermal capacity, *Water chemistry, *Injection wells, *Geothermal wells, *Chemical properties, *Geochemistry, *Model studies, *Data interpretation, Groundwater, Chemical reactions, Thermal energy, Geothermal resources, Water temperature, Mathematical equations, Ion exchange.

The changes in the concentrations of Ca, dissolved silica, and alkalinity of the recovery waters of four short-term aquifer thermal energy storage test cycles with respect to the injection waters and the correlation of these concentrations with recovery water temperatures indicate that quartz and calcite dissolved during hot water storage. This hypothesis was supported by chemical equilibrium modeling and mass balance calculations. Magnesium concentrations were lower in recovery waters than in injection waters. Chemical equilibrium modeling indicated that a Mg silicate (talc) could have precipitated. Potassium concentrations correlated well with temperatures, probably because of ion exchange involving potassium feldspars in the aquifer. (Author's abstract)

W88-02778

PARAMETER ESTIMATION IN GROUNDWATER: CLASSICAL, BAYESIAN, AND DETERMINISTIC ASSUMPTIONS AND THEIR IMPACT ON MANAGEMENT POLICIES,
Wright State Univ., Dayton, OH.
For primary bibliographic entry see Field 4B.
W88-02780

PERTURBATION BOUNDARY ELEMENT CODE FOR STEADY STATE GROUNDWATER FLOW IN HETEROGENEOUS AQUIFERS,
Delaware Univ., Newark. Dept. of Civil Engineering.
O. E. Lafe, and A. H.-D. Cheng.
Water Resources Research WRERAQ, Vol. 23, No. 6, p 1079-1084, June 1987. 6 fig, 1 tab, 11 ref.

Descriptors: *Groundwater movement, *Aquifers, *Data interpretation, *Darcys Law, *Mathematical equations, Steady state flow, Boundary element code, Porous media, Piezometric head, Laplace equation, Mathematical studies, Poisson equations.

A boundary element code for the steady state Darcy's flow in heterogeneous porous media is based on the expansion of the piezometric head into perturbation series. The governing equation is decomposed into a Laplace equation and a sequence of Poisson equations with known right sides. Regular boundary element procedure is applied for their solutions. Three numerical examples with moderate hydraulic conductivity variations are provided to demonstrate the applicability of the code. The convergence of the perturbation solution is discussed using a one-dimensional problem. (Author's abstract)
W88-02785

ANALYTICAL AND EXPERIMENTAL SOLUTIONS FOR DRAINAGE OF SLOPING LANDS WITH TIME-VARYING RECHARGE,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India).
S. Ram, and H. S. Chauhan.
Water Resources Research WRERAQ, Vol. 23, No. 6, p 1090-1096, June 1987. 5 fig, 4 tab, 19 ref.

Descriptors: *Subsurface drainage, *Phreatic aquifers, *Groundwater recharge, *Aquifers, *Data interpretation, Model studies, Mathematical equations, Mathematical studies, Slopes, Drainage systems, Design criteria, Differential equations, Water table, Boussinesq equation, Drains, Groundwater.

M. J. Boussinesq's (1904) nonlinear partial differential equation for unsteady state flow of water through a phreatic aquifer resting on a sloping impervious barrier and receiving time-varying recharge was solved. Two patterns of recharge rates, i.e., linearly increasing and exponentially declining with time were considered. The initial conditions of the water table were taken at the drain level. Transformations were devised to transform the resulting approximate linearized Boussinesq equation to the form of a one-dimensional heat flow equation for each case of recharge pattern, and analytical solutions for the height of the water table between parallel drains were obtained in the form of a convergent series. The analytical solutions were experimentally verified with a Hele-Shaw model. A reasonably close agreement was found in the computed and observed phreatic surfaces. The results showed that the analytical solutions presented can be used with reasonable accuracy for designing subsurface drainage in sloping aquifers. (Author's abstract)
W88-02787

FLOW EQUATIONS IN TERMS OF PIEZOMETER LEVELS FOR NONISOTHERMAL FLUID IN LOW-PERMEABILITY POROUS MEDIUM,
Rockwell International, Richland, WA. Rockwell Hanford Operations.
For primary bibliographic entry see Field 5E.
W88-02788

FLUID FLOW IN CRYSTALLINE ROCKS: RELATIONSHIPS BETWEEN GROUNDWATER SPRING ALIGNMENTS AND OTHER SURFACE LINEATIONS AT ALTNABREAC, UNITED KINGDOM,
British Geological Survey, Keyworth (England).
N. R. Brereton, T. J. McEwen, and M. K. Lee.
Journal of Geophysical Research JJGBDU, Vol. 92, No. B8, p 7797-7806, July 1987. 6 fig, 19 ref.

Descriptors: *Groundwater movement, *Geologic fractures, *Radioactive waste disposal, *Fault springs, *Path of pollutants, *Surface-groundwater relations, *Granites, Surveys, Groundwater, Springs, Mapping.

The Strath Halladale Granite in the region around Altnabreac, northern Scotland, United Kingdom, has been studied for use in disposing of radioactive wastes by establishing a relationship between the regional distribution of faults and fracture zones, surface discharges of groundwater, and groundwater flow systems. A major component of the groundwater flow is through the rock fractures. Because of the extensive superficial cover the surface expression of major fractures was difficult to identify from the limited surface exposures. Geophysical surveys and aerial photography enabled the authors to define lineations which could be related to the presence of fractures. The areal distribution of groundwater spring discharges was mapped using thermal infrared line scan techniques. The distribution of these springs has been studied to assess their relationships to surface lineaments and to correlations with geophysical and fracture mapping data. (Author's abstract)
W88-02834

HYDROLOGICAL PROPERTIES OF TOPOPAH SPRING TUFF: LABORATORY MEASUREMENTS,
Lawrence Livermore National Lab., CA.
For primary bibliographic entry see Field 5E.
W88-02836

HYDROSEISMICITY - A HYPOTHESIS FOR THE ROLE OF WATER IN THE GENERATION OF INTRAPLATE SEISMICITY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Geological Sciences.
J. K. Costain, G. A. Bollinger, and J. A. Speer.
Geology GLGYB, Vol. 15, No. 7, p 618-621, July 1987. 2 fig, 33 ref.

Descriptors: *Model studies, *Hydroseismicity, *Interplate seismicity, *Geohydrology, *Earthquakes, *Seismic properties, *Groundwater, *Geologic fractures, Water table, Hydraulic head, Recharge, Hydrology, Tectonics.

A new hypothesis, termed hydroseismicity, suggests that in crustal volumes with fracture permeability, natural increases in hydraulic head caused by transient increases in the elevation of the water table in recharge areas of groundwater basins can be transmitted to depths of 10-20 km and thereby trigger earthquakes. The flow-path geometry resembles, except for scale, the model familiar to groundwater hydrologists for near-surface flow. Possible trigger mechanisms for hydroseismicity include small increases in fluid pressure at hypocentral depths caused by such transient increases, the dissolution of minerals in water, and the solubility of water in minerals (hydrolytic weakening) that leads to structural weakening. A change in water level of less than 1 m (< 0.1 bar) is sufficient, in principle, to trigger seismicity along a preexisting fault in a crust already tectonically stressed close to failure. Flow lines in the hydroseismicity model are over distances of tens of kilometers. Implicit in the model is a primarily diffuse distribution of epicenters (as is observed in the region) rather than concentrations along discrete geologic (faults) or geomorphic (rivers) elements. (Author's abstract)
W88-02837

HYDROGEOCHEMICAL STUDY OF THE DRINKING WATER FROM THE KHAYBAR VILLAGE, SW SAUDI ARABIA,
King Saud Univ., Riyadh (Saudi Arabia).
A. A. Almohandis.
Toxicological and Environmental Chemistry TXECBP, Vol. 15, No. 3, p 197-206, 1987. 4 fig, 3 tab, 10 ref.

Descriptors: *Hydrogeochemistry, *Drinking water, *Wells, *Groundwater, Saudi Arabia, Water quality, Odors, Tastes, Alkalinity.

The results of chemical analysis of four drinking waters from the Khaybar village, SW Saudi Arabia are presented. Four main water-wells in the Khaybar village were investigated. The Khaybar ground water is clear without odor but its taste differs according to the amount of total dissolved solids (T.D.S.). The pH values of such water are slightly alkaline. T.D.S. of the Khaybar water is higher than the Saudi highest desired level, but it is generally within the Saudi maximum permissible level. Good drinking quality water can be found in Al Mazaab and Al Tilah water-wells in the Khaybar village. The other two water-wells can be used for irrigation purposes only. The geological features of the Khaybar area suggest a meteoric origin for the Khaybar groundwater which has been stored in the fractured metamorphic and igneous rocks and in alluvial deposits. (Author's abstract)
W88-02883

COMPUTED SOLID PHASES LIMITING THE CONCENTRATION OF DISSOLVED CONSTITUENTS IN BASALT AQUIFERS OF THE COLUMBIA PLATEAU IN EASTERN WASHINGTON,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 2K.
W88-02894

HYDRO-GEOCHEMICAL STUDIES OF URANIUM MILL-TAILING PILES AT RIVERTON, WYOMING AND MAYBELL, COLORADO,
California Univ., Berkeley. Lawrence Berkeley Lab.
For primary bibliographic entry see Field 5B.
W88-02897

GROUND-WATER DAMS FOR RURAL WATER SUPPLY IN DEVELOPING COUNTRIES,
Royal Inst. of Tech., Stockholm (Sweden). Institutionen foer Kulturteknik.
For primary bibliographic entry see Field 8A.
W88-02924

GROUND-WATER QUALITY DATA FROM THE NORTHERN MISSISSIPPI EMBAYMENT -- ARKANSAS, MISSOURI, KENTUCKY, TENNESSEE AND MISSISSIPPI,
Geological Survey, Nashville, TN. Water Resources Div.
J. V. Brahana, T. O. Mesko, J. F. Busby, and T. F. Kraemer.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-683, 1985. 15 p, 2 fig, 6 tab, 21 ref.

Descriptors: *Groundwater quality data, *Groundwater sampling, *Arkansas, *Missouri, *Illinois, *Kentucky, *Tennessee, *Mississippi, Major constituents, Trace constituents, Dissolved gases, Stable isotopes, Unstable isotopes, Northern Mississippi Embayment, New Madrid Seismic Zone, New Madrid Earthquake Region, McNairy Sand, Nacatoch Sand, Ripley formation.

Groundwater quality data were collected from 42 selected wells in the McNairy-Nacatoch-Ripley and the lower Wilcox aquifers of the northern Mississippi embayment. The study is part of the Gulf Coast Regional Aquifer System Analysis (GC RASA) study; the data will be used for geochemical modeling of mineral saturation and mass transfer in the McNairy-Nacatoch-Ripley aquifer. The report contains two figures showing the location of sampling sites for each of the two aquifers, six tables of data which contain (1) well descriptions and (2) concentrations of major constituents, trace

constituents, dissolved gases, stable and unstable isotopes of low mass (C, H, O, and S), and unstable isotopes of high mass (Rn, Ra, and U), and a brief documentation of the methods used for sample collection and analysis. (USGS)
W88-02955

WATER-QUALITY DATA FOR AQUIFERS IN EAST-CENTRAL NEW JERSEY, 1981-82,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-02956

GEOHYDROLOGIC DATA FOR TEST WELL UE-25P 1, YUCCA MOUNTAIN AREA, NYE COUNTY, NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
R. W. Craig, and K. A. Johnson.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report, Basic Data 84-450, 1984. 63 p, 49 fig, 6 tab, 9 ref.

Descriptors: *Hydrologic data, *Groundwater hydrology, *Pumping tests, *Nevada Test Site, *Nevada, Water quality, Water level, Nye County, Yucca Mountain.

This report presents the following data for test well UE-25p 1 in Nye County, Nevada: drilling operations, lithology, availability of borehole geophysical logs, water levels, future availability of core analyses, water chemistry, pumping tests, borehole-flow surveys, and packer-injection tests. The well is one of a series of test wells drilled in and near Yucca Mountain adjacent to the Nevada Test Site in cooperation with the U.S. Department of Energy. These investigations are part of the Nevada Nuclear Waste Storage Investigations to identify suitable sites for underground storage of high-level radioactive wastes. Test well UE-25p 1 was the first in the Yucca Mountain area to penetrate rocks of Paleozoic age. To a depth of 1,244 meters, the rocks are predominantly ash-flow tuffs of Tertiary age. From 1,244 meters to a total depth of 1,805 meters, the rock is dolomite of Paleozoic age. (USGS)
W88-02957

WATER RESOURCES MANAGEMENT IN LOWNDES COUNTY, MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.
W88-02961

WATER RESOURCES MANAGEMENT IN ALCORN COUNTY, MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.
W88-02962

GROUND WATER QUALITY IN SOUTHEASTERN MINNESOTA,
Minnesota Univ., Minneapolis. School of Public Health.
For primary bibliographic entry see Field 5A.
W88-02968

NITRATE IN THE COLUMBIA AQUIFER, CENTRAL DELMARVA PENINSULA, MARYLAND,
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-02969

GROUND-WATER SYSTEM IN THE LA GRANGE AQUIFER NEAR LA GRANGE, SOUTHEASTERN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
W. B. Borchert.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4024, 1985. 56 p, 26 fig, 6 tab, 21 ref.

Descriptors: *Wyoming, *Model studies, *Computer models, *Groundwater movement, *Aquifers, Geologic formations, Potentiometric level, Hydrographs, Irrigation wells, Surface irrigation, La Grange aquifer, Sensitivity analysis.

Groundwater is being developed from the La Grange aquifer in southeastern Wyoming. It consists of saturated permeable alluvium that is hydraulically connected with most of the underlying White River Group. In the area of principal interest east of Horse Creek, Hawk Springs Reservoir and 14 adjacent wells used to supplement surface-water supply in the reservoir are in a natural discharge area. Upgradient of the reservoir there are 28 irrigation wells in about a 6-square-mile area. In this area, water levels declined between 3 and 12 feet from 1973 to 1978 causing concern about the effects of well pumpage on the hydrologic system. A digital model was developed and used to simulate the two-dimensional groundwater flow system in the unconfined La Grange aquifer. Transient simulations were made for 1973-78 using 12 time periods and for 1978-80 using 25 time periods. The calibrated digital model was used to simulate four 6-month pumping alternatives including three hypothetical alternatives for the area of principal interest east of Horse Creek. The reservoir altitude was held constant, approximating a reservoir volume 7,000 acre-feet. Pumping alternative 1 simulated historic conditions for 1973-78 including monthly recharge from precipitation which was included in the next three pumping alternatives. For pumping alternative 1, the calculated rate of discharge at the end of the 6-month simulation was 5.2 cubic feet per second from the aquifer to the reservoir. At the end of the 6-month simulations for pumping alternatives 2 and 3, the calculated rate of discharge to the reservoir was decreased to 0.4 cubic feet per second by pumpage from the 14 wells and to 3.8 cubic feet per second by pumpage from the 28 irrigation wells. For pumping alternative 4, pumpage from the total 42 wells resulted in a 1.0 cubic feet per second loss from the reservoir to the aquifer. (USGS)
W88-02970

MAP SHOWING OUTCROPS OF PRE-QUATERNARY ASH-FLOW TUFFS AND VOLCANICLASTIC ROCKS, BASIN AND RANGE PROVINCE, NORTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-02971

STEADY-STATE COMPUTER MODEL OF THE WATER-TABLE AQUIFER IN THE MULLICA RIVER BASIN, THE PINE BARRENS, NEW JERSEY,
Geological Survey, Trenton, NJ. Water Resources Div.
A. W. Harbaugh, and C. L. Tilley.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4295, 1984. 33 p, 9 fig, 4 tab, 10 ref.

Descriptors: *Computer models, *Groundwater-surface relationships, *Surface-groundwater relationships, *New Jersey, Groundwater, Streams, Pine Barrens.

A two-dimensional steady-state model of the water-table aquifer of the Mullica River basin was made to evaluate the flow system and data required to simulate it. The Mullica River basin covers 570 sq mi and is drained by numerous shallow streams. The water-table aquifer consists of sand and gravel intermixed with clay and silt. The computer model is based on a finite-difference method with stream-seepage equations coupled to the groundwater equation. The model was applied to the approximately steady-state conditions of March 1979. Initial estimates of streambed hydraulic conductance and aquifer hydraulic conductivity were adjusted until model water level matched measured water level within 5 ft for 41 of 42 wells. Also, model streamflow was within 20 percent of measured streamflow at 12 of 15 sites. The 5,000-ft grid spacing should be adequate for a future predictive model. The natural flow system is adequately simulated by a two-dimensional model. (USGS)
W88-02972

HYDROGEOLOGY OF THE CROSS BAR RANCH WELL-FIELD AREA AND PROJECTED IMPACT OF PUMPING, PASCO COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
C. B. Hutchinson.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4001, 1985. 89 p, 36 fig, 10 tab, 44 ref.

Descriptors: *Computer models, *Groundwater movement, *Hydrogeology, *Florida, Water management, Pumping, Evapotranspiration, Pasco County.

The hydrogeology and development of a groundwater flow model are described for a 121-square-mile area in Pasco County, Florida. The hydrogeologic framework consists of the surficial aquifer--a thin blanket of sand--and the underlying carbonates of the upper Floridian aquifer. The aquifers are separated by a leaky sand and clay confining unit. The Cross Bar Ranch well field occupies 13 square miles and contains 17 production wells averaging about 700 feet deep and tapping the upper Florida aquifer. Procedures to calibrate, test sensitivity to input parameters, and validate the model's accuracy are described. Pumping at 30 million gallons per day should result in 5 feet of decline in the water table of the surficial aquifer over an 8-square-mile area and in the potentiometric surface of the Upper Florida aquifer over a 15-square-mile area. Under the 45-million-per-day maximum permitted rate, drawdown should be 5 feet or more in the water table and potentiometric surface over areas of 16 and 28 square miles, respectively. At the center of pumping, water levels could decline 15 to 25 feet. The surficial aquifer could possibly be completely dewatered in a small area of the well field when pumping is at the maximum rate. (USGS)
W88-02973

HYDROGEOLOGY OF EASTERN MICHAUD FLATS, FORT HALL INDIAN RESERVATION, IDAHO,
Geological Survey, Idaho Falls, ID. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-02976

STIMULATED EFFECTS OF INCREASED RECHARGE ON THE GROUND-WATER FLOW SYSTEM OF YUCCA MOUNTAIN AND VICINITY, NEVADA-CALIFORNIA,
Geological Survey, Denver, CO. Water Resources Div.
J. B. Czarnecki.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4344, 1985. 33 p, 16 p, 16 fig, 3 tab, 15 ref.

Descriptors: *Groundwater flow model, *Finite-element simulation, *Nevada, *California, Groundwater recharge, Sensitivity analysis, Simulated water table change, Nuclear waste repository, Paleoclimatology, Groundwater movement, Path of pollutants, Radioactive wastes.

A study was performed to assess the potential effects of changes in future climatic conditions on the groundwater system in the vicinity of Yucca Mountain, the site of a potential mined geologic repository for high-level nuclear wastes. These changes probably would result in greater rates of precipitation and, consequently, greater rates of recharge. The study was performed by simulating the groundwater system, using a two-dimensional,

finite-element, groundwater flow model. The simulated position of the water table rose as much as 130 meters near the U.S. Department of Energy's preferred repository area at Yucca Mountain for a simulation involving a 100-percent increase in precipitation compared to modern-day conditions. Despite the water table rise, no flooding of the potential repository would occur at its current proposed location. According to the simulation, springs would discharge south and west of Timber Mountain, along Fortymile Canyon, in the Amargosa Desert near Lathrop Wells and Franklin Lake playa, and near Furnace Creek Ranch in Death Valley, where they presently discharge. Simulated directions of groundwater flow paths near the potential repository area generally would be the same for the baseline (modern-day climate) and the increased-recharge simulations, but the magnitude of flow would increase by 2 to 4 times that of the baseline-simulation flow. (USGS)
W88-02977

MAPS SHOWING GROUND-WATER UNITS, WITHDRAWAL, AND LEVELS; SPRINGS; AND DEPTH TO GROUND WATER, BASIN AND RANGE PROVINCE, NORTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
J. E. Reed, M. S. Bedinger, W. H. Langer, R. L. Ireland, and D. A. Mulvihill.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations 83-4115-A, 1984. 11 p, 5 fig, 17 ref, 4 maps.

Descriptors: *Groundwater, *Groundwater movement, *Basin and Range province, Selected groundwater withdrawal, Groundwater levels, Springs, Maps, Northern California.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of four maps describing hydrologic properties of the northern California part of the Basin and Range province. The first map, at a scale of 1:500,000, shows groundwater units, consolidated rock or basin fill, generalized groundwater flow directions, and natural discharge areas. A second map, at a scale of 1:1,000,000, shows groundwater withdrawal in the area for 1970. The third map, at a scale of 1:500,000, shows the approximate altitude of the water table and the location, temperature, and flow of selected springs of 10 gallons per minute or more. The altitude of the water table is shown by contours where sufficient data exists; otherwise it is shown by data points. The fourth map, at a scale 1:1,000,000, shows the depth to groundwater and areas of basin fill or consolidated rock. In areas where the depth to the water table is less than 500 feet, the depth is shown by lines of equal depth to water or data points where data are insufficient to draw lines. Areas where the depth to the water table is generally greater than 500 feet are shown as shaded areas. (USGS)
W88-02981

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND RANGE PROVINCE, NORTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
T. H. Thompson, and R. Chappell.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4115-B.

Descriptors: *Groundwater, *Water quality data, *California, *Maps, Hydrogeology, Basin and Range province.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps at a scale of 1:500,000 that describe the ground water quality of the northern California part of the Basin and Range province. The first map shows the areal distribution of dissolved solids of groundwater in the basin-fill deposits. The second map shows the areal distribution of the dominant chemical type of groundwater in the basin-fill deposits. (USGS)
W88-02983

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND RANGE PROVINCE, TEXAS,
Geological Survey, Lakewood, CO. Water Resources Div.
T. H. Thompson, and J. A. Nuter.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Maps 83-4121-C, 1984. 6 p, 4 fig, 8 ref, 2 maps.

Descriptors: *Groundwater, *Water quality data, *Maps, *Texas, Hydrogeology, Basin and Range province.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps at a scale of 1:500,000 that characterize the groundwater quality of the Texas part of the Basin and Range province. The first map shows the areal distribution of dissolved solids of groundwater in the basin-fill deposits. The second map shows the areal distribution of the dominant chemical type of groundwater in the basin-fill deposits. (USGS)
W88-02984

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER BASIN AND RANGE PROVINCE, SOUTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
T. H. Thompson, J. A. Nuter, W. R. Moyle, and L. R. Woolfenden.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4116-C, 1984. 8 p, 4 fig, 28 ref, 2 maps.

Descriptors: *Groundwater, *Water quality data, *Maps, *California, Hydrogeology, Basin and Range province.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps at a scale of 1:500,000 describing the groundwater quality of the southern California part of the Basin and Range province. The first map shows the areal distribution of dissolved solids of groundwater in the basin-fill deposits. Data from selected points are also shown in both basin-fill and consolidated rock. The second map shows the areal distribution of the dominant chemical type of groundwater in the basin-fill deposits. Selected data points are also shown in both basin-fill and consolidated rock. (USGS)
W88-02985

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER BASIN AND RANGE PROVINCE, IDAHO,
Geological Survey, Lakewood, CO. Water Resources Div.
T. H. Thompson, and R. Chappell.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4117-B, 6 p, 4 fig, 10 ref, 2 maps.

Descriptors: *Groundwater, *Water quality data, *Maps, *Idaho, Hydrogeology, Basin and Range province.

This map report is part of a U.S. Geological Survey project to characterize the geology and hydrology of the Basin and Range province. The report consists of two maps at a scale of 1:500,000 describing the groundwater quality of the Idaho portion of the Basin and Range province. The first map shows the areal distribution of dissolved solids in groundwater in the basin-fill deposits. The second map shows the areal distribution of the dominant chemical type of groundwater in the basin-fill deposits. (USGS)
W88-02986

MAP SHOWING OUTCROPS OF PRE-QUATERNARY ASH-FLOW TUFFS AND VOLCANICLASTIC ROCKS, BASIN AND RANGE, PROVINCE, UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W88-02988

MAP SHOWING OUTCROPS OF GRANITIC ROCKS AND SILICIC SHALLOW-INTRUSIVE ROCKS, BASIN AND RANGE PROVINCE, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W88-02989

MAP SHOWING OUTCROPS OF TERTIARY BASALTIC ROCKS, BASIN AND RANGE PROVINCE, NORTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W88-02990

MAP SHOWING OUTCROPS OF BASALTIC ROCKS OF EARLY QUATERNARY AND TERTIARY AGE, BASIN AND RANGE PROVINCE, SOUTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W88-02991

MAP SHOWING OUTCROPS AND LITHOLOGY OF INTRUSIVE ROCKS, BASIN AND RANGE PROVINCE AND VICINITY, TRANSPECOS TEXAS,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W88-02992

MAP SHOWING OUTCROPS OF PRE-QUATERNARY ASH-FLOW TUFFS, BASIN AND RANGE PROVINCE, SOUTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W88-02995

MAP SHOWING OUTCROPS OF GRANITIC ROCKS AND SILICIC SHALLOW-INTRUSIVE ROCKS, BASIN AND RANGE PROVINCE, NORTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W88-02996

MAP SHOWING OUTCROPS OF THICK, DOMINANTLY ARGILLACEOUS SEDIMENTARY AND METASEDIMENTARY ROCKS, BASIN AND RANGE PROVINCE, IDAHO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W88-02997

HYDROLOGY OF THE FERRON SANDSTONE AQUIFER AND EFFECTS OF PROPOSED SURFACE-COAL MINING IN CASTLE VALLEY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.

For primary bibliographic entry see Field 4C.
W88-03000

PRELIMINARY ASSESSMENT OF LAND-SURFACE SUBSIDENCE IN THE EL PASO AREA, TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 6G.
W88-03009

HYDROGEOLOGIC AND WATER-QUALITY CHARACTERISTICS OF THE UPPER CARBONATE AQUIFER, SOUTHEAST MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
J. F. Ruhl, and R. J. Wolf.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4150, 1984. 2 sheets (map), 14 fig, 2 tab, 12 ref.

Descriptors: *Aquifer characteristics, *Water quality, *Underground waste disposal, *Geohydrology, *Minnesota, Karst hydrology, Hollandale embayment, Upper Carbonate aquifer.

The Upper Carbonate aquifer is part of a sequence of sedimentary bedrock units. It was deposited from Paleozoic seas which occupied a depression known as the Hollandale embayment. The aquifer comprises four formations, which, in ascending order, are the Galena Dolomite, Dubuque Formation, Maquoketa Shale, and Cedar Valley Limestone. Total thickness of the aquifer is as much as 650 feet. Water flows mostly through fractures and solution channels. Regional groundwater movement is toward the periphery of the aquifer and locally toward river and bedrock valleys. Yields from wells in the aquifer range from about 100 to 500 gallons per minute. Water in the Upper Carbonate aquifer is of acceptable quality for most uses, but sinkholes and disappearing streams locally provide direct passageways for entry of contaminants into the aquifer. Calcium magnesium bicarbonate type water is most common in the aquifer. Concentrations of dissolved solids and some major ions, specifically magnesium, sodium, bicarbonate, and sulfate, are generally highest in the southwest part. (USGS)
W88-03011

PRELIMINARY ASSESSMENT OF THE GROUND-WATER RESOURCES OF THE ALLUVIAL AQUIFER, WHITE RIVER VALLEY, RIO BLANCO COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
W. P. Van Liew, and M. L. Gesink.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4307, 1985. 82 p, 30 fig, 10 tab, 61 ref.

Descriptors: *Groundwater, *Colorado, *Alluvial aquifers, Alluvium, Energy, White River Valley, Water quality, Water yield.

A preliminary study of the alluvial aquifer in the White River Valley was conducted to assess aquifer extent and the occurrence, availability, and chemical quality of water in the aquifer. The aquifer in the study area underlies 35 square miles. Aquifer width ranges from 0.1 to 1.5 miles and averages 0.5 miles. Saturated thickness ranges from zero to more than 140 feet and averages 22 feet. The aquifer is unconfined except west of the Grand Hogback, where artesian conditions were observed at several locations. Well yields usually are less than 25 gallons per minute. At the Meeker municipal well field in Agency Park, wells reportedly could yield more than 1,000 gallons per minute each. Based on nine aquifer tests, transmissivity ranges from 860 to 93,000 feet squared per day, and hydraulic conductivity ranges from 70 to 1,550 feet per day. The estimated total volume of water in storage in the aquifer in the study area is 103,000 acre-feet. Groundwater type in the eastern part of the study area is calcium bicarbonate; to the west, water type is sodium sulfate. Water in the aquifer is classified as very hard throughout the study area. Specific conductance generally increases from east to west. (USGS)
W88-03012

APPROXIMATE POTENTIOMETRIC SURFACE FOR AQUIFER UNIT A2, CRETACEOUS-TERTIARY SAND AQUIFER SYSTEM, SOUTHEASTERN UNITED STATES, PRIOR TO DEVELOPMENT,
Geological Survey, Atlanta, GA. Water Resources Div.
V. A. Stricker, W. R. Aucott, R. E. Faye, J. S. Williams, and M. J. Mallory.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4019, 1985. 1 sheet (map), 2 fig, 47 ref.

Descriptors: *Water levels, *Aquifers, *Aquifer system, *Coastal Plain, *RASA, Geohydrology, Maps, South Carolina, Georgia, Alabama, Mississippi, Southeastern United States, Cretaceous, Tertiary, Sand aquifer, Potentiometric maps.

A generalized potentiometric surface map prepared as part of the southeastern United States, Regional Sand Aquifer-System Analysis defines the altitude of water levels under conditions prior to development for aquifer unit A2, the upper group of aquifers in the sand aquifer system. Aquifer unit A2, consisting of lower Tertiary sands, is under artesian conditions except locally in the recharge areas. The regional flow direction is to the rivers in the area where the unit outcrops, west toward the Mississippi River in Mississippi, and southward to the Gulf of Mexico in Alabama and West Georgia. In eastern Georgia and South Carolina, the flow is southeast toward the Atlantic Ocean. (USGS)
W88-03013

APPROXIMATE POTENTIOMETRIC SURFACE FOR AQUIFER UNIT A3, CRETACEOUS-TERTIARY SAND AQUIFER SYSTEM, SOUTHEASTERN UNITED STATES, PRIOR TO DEVELOPMENT,
Geological Survey, Atlanta, GA. Water Resources Div.
V. A. Stricker, W. R. Aucott, R. E. Faye, J. S. Williams, and M. J. Mallory.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4031, 1985. 1 sheet (map), 2 fig, 46 ref.

Descriptors: *Water level, *Aquifers, *Aquifer systems, *Coastal Plain, *RASA, *Cretaceous, *Tertiary, *Sand aquifer, Geohydrology, Maps, South Carolina, Georgia, Alabama, Mississippi, Southeastern United States.

A generalized potentiometric surface map prepared as part of the southeastern United States, Regional Sand Aquifer-System Analysis defines the altitude of water levels under conditions prior to development for aquifer unit A3, the middle group of aquifers in the sand aquifer system. Aquifer unit A3, consisting of Upper Cretaceous and Tertiary sands, is under artesian conditions except locally in the recharge areas. The regional flow direction is to the rivers in the area where the unit outcrops, west toward the Mississippi River in Mississippi, and southward to the Gulf of Mexico in Alabama and West Georgia. In eastern Georgia, the flow is southeast toward the Atlantic Ocean, and in South Carolina, the direction of flow is southeast toward the Pee Dee River. (USGS)
W88-03015

GEOHYDROLOGIC UNITS OF THE GULF COASTAL PLAIN IN ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
J. C. Petersen, M. E. Broom, and W. V. Bush.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4116, 1985. 20 p, 11 fig, 1 tab, 26 ref, 9 plates (maps).

Descriptors: *Geohydrologic units, *Geohydrology, *Geologic mapping, *Saline water, *Arkansas, *Gulf Coastal Plain, Groundwater, Water quality, Aquifers, Confining beds, Sparta Sand, Cane River Formation, Carrizo Sand, Wilcox Group, Midway Group, Nacatoch Sand, Trinity Group, Tokio Formation.

This report describes geohydrologic units of the Jurassic, Cretaceous, Tertiary and Quaternary Systems and of the Paleozoic Era in the Gulf Coastal Plain in Arkansas. Structure contour maps on top of the Paleozoic rocks, Trinity Group, Tokio Formation, Nacatoch Sand, Midway Group, Wilcox Group, Carrizo Sand, Cane River Formation, Sparta Sand, and the Memphis Sand are included. Thickness maps of the Wilcox Group, Carrizo Sand, Cane River Formation, Sparta Sand, and the Memphis Sand and maps showing lines of equal dissolved-solids concentrations of the Nacatoch Sand, Wilcox Group, Carrizo Sand, Cane River Formation, and Sparta Sand are also included. The dissolved-solids maps are at about a 1:2 million scale. All other maps are at a 1:1 million scale. Brief descriptions of the geohydrologic units mentioned above and of the Cook Mountain and Cockfield Formations and the Jackson Group are also included. (USGS)
W88-03018

ESTIMATION OF GROUND-WATER RECHARGE IN SANTA MARIA VALLEY, CALIFORNIA, 1978-80,
Geological Survey, San Diego, CA. Water Resources Div.
P. Lipinski.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4129, 1985. 17 p, 5 fig, 4 tab, 8 ref.

Descriptors: *Groundwater, *Recharge, *California, Seepage loss, Infiltration, Santa Maria Valley.

Infiltration from the Santa Maria River and the lower part of the Sisquoc River constitutes most of the groundwater recharge to the aquifer system of Santa Maria Valley, California. The annual recharge volumes commonly are much greater or smaller than the long-term average annual recharge. A comparison of two methods of estimating annual recharge indicates that, in Santa Maria Valley, a seepage-loss method is comparable to a water-level-change method. Both methods indicate that recharge was about 600,000 acre-feet during 1978-80. By the seepage-loss method, annual recharges for 1978, 1979, and 1980 are estimated as 290,000, 130,000, and 190,000 acre-feet. Using the water-level-change method, annual recharges during 1978, 1979, and 1980 are estimated at 230,000, 190,000, and 160,000 acre-feet. A log-Pearson Type III probability distribution of annual flows gaged on the Sisquoc River indicates that average annual recurrence intervals of recharge events equal to those of 1978, 1979, and 1980 are 20, 4, and 10 years. (USGS)
W88-03019

SUMMARY OF NORTHERN ATLANTIC COASTAL PLAIN HYDROLOGY AND ITS RELATION TO DISPOSAL OF NUCLEAR WASTE IN BURIED CRYSTALLINE ROCK,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 5E.
W88-03020

APPROXIMATE POTENTIOMETRIC SURFACE FOR AQUIFER UNIT A4, CRETACEOUS-TERTIARY SAND AQUIFER SYSTEM, SOUTHEASTERN UNITED STATES, PRIOR TO DEVELOPMENT,
Geological Survey, Atlanta, GA. Water Resources Div.
V. A. Stricker, W. R. Aucott, R. E. Faye, J. S. Williams, and M. J. Mallory.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4364, 1985. 1 sheet (map), 2 fig, 26 ref.

Descriptors: *Water levels, *Aquifers, *Aquifer systems, *Coastal Plain, *RASA, Geohydrology, Maps, South Carolina, Georgia, Mississippi, Alabama, Southeastern United States, Cretaceous, Tertiary, Sand aquifer.

A generalized potentiometric surface map prepared as part of a regional analysis of sand aquifer system defines the altitude of water levels under pre-development conditions for aquifer unit A4, the lowermost group of aquifers in the sand aquifer system. Aquifer unit A4, consisting of Upper and Lower Cretaceous sands, is under artesian conditions except locally in the recharge areas. The regional flow direction is to the rivers in the area where the unit outcrops and southward to the Gulf of Mexico in Mississippi, Alabama, and West Georgia. In coastal Georgia and South Carolina, the direction of flow is east northeast parallel to the coast and into North Carolina. (USGS)
W88-03024

GROUND-WATER LEVELS AND USE OF WATER FOR IRRIGATION IN THE SARATOGA VALLEY, SOUTH-CENTRAL WYOMING, 1980-81,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 6G.
W88-03025

QUALITY OF GROUND WATER IN SOUTHEASTERN-SOUTH CENTRAL WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
G. L. Turney.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4262, 1986. 158 p, 2 fig, 5 plates, 4 tab, 20 ref.

Descriptors: *Water quality, *Groundwater, *Washington, Ions, Metals, Basalts, Unconsolidated aquifers, Yakima, Hanford, Walla Walla, Drinking water regulations.

In 1982 groundwater was sampled at over 100 sites in the southeastern-south central region of Washington and analyzed for pH, specific conductance, and concentrations of fecal-coliform bacteria, major dissolved irons, and dissolved iron, manganese, and nitrate. Twenty percent of the samples were analyzed for concentrations of dissolved aluminum, arsenic, barium, cadmium, chromium, cooper, lead, mercury, selenium, silver, and zinc. The predominant water type was calcium bicarbonate. Some sodium bicarbonate water was found in samples from the Lower Yakima, Horse Heaven Hills, and Walla Walla-Tucannon subregions. Dissolved solids concentrations were typically less than 500 mg/L (milligrams per liter). Median iron and manganese concentrations were less than 20 micrograms/L except in the Palouse subregion, where the median concentration of iron was 200 micrograms/L and the median concentrations of manganese was 45 micrograms/L. Generally, trace-metal concentrations were also less than 10 micrograms/L except for barium, copper, and zinc. Nitrate concentrations were less than 1.0 mg/L in waters from half the wells sampled. Concentrations greater than 5.0 mg/L were found in areas of the Lower Yakima, Walla Walla-Tucannon and Hanford subregions. No fecal-coliform bacteria were detected. U.S. Environmental Protection Agency drinking water regulation limits were generally not exceeded, except for occasional high concentrations of nitrate or dissolved solids. The historical data for the region were evaluated for these same constituents. Quantitative differences were found, but the historical and 1982 data led to similar qualitative conclusions. (USGS)
W88-03027

HYDROLOGIC APPRAISAL OF THE PINE BARRENS, SUFFOLK COUNTY, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
R. K. Krulikas.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4271, 1986. 53 p, 8 fig, 10 tab, 15 ref.

Descriptors: *Geohydrology, *Aquifers, *Water resources data, *Suffolk County, Hydrology, Geology, Groundwater, Recharge, Water quality, Brookhaven, Riverhead, Southhampton, Upper glacial aquifer, Magothy aquifer, New York.

The groundwater resources of the Pine Barrens, in southeastern Suffolk County, were appraised during 1982-83 for their potential for use as a supply of potable water. The study area encompasses approximately 50 square miles. The Precambrian bedrock is overlain by Cretaceous, Pleistocene, and Holocene deposits. The surficial material consists of morainal and outwash deposits overlain by recent beach and marsh deposits. The groundwater reservoir consists of three aquifers--the Lloyd and the Magothy of Cretaceous age and the upper glacial of Pleistocene age. The water is generally of suitable quality for drinking and most other uses except in several localized spots where point-source contamination has been documented. Precipitation is the sole source of recharge. Average annual precipitation recorded in the area during 1943-82 was 43 inches, about half of which reaches the groundwater reservoir. Overland runoff is estimated to be 0.5 inches per year, and evapotranspiration 23 inches per year. Total public water-supply withdrawal in the area in 1982 is estimated to have been 9.09 million gallons per day (Mgal/d). The upper glacial aquifer is the major source of public water; pumpage in 1982 was 7.88 Mgal/d; pumpage from the Magothy was 1.02 Mgal/d, and pumpage from the Lloyd aquifer was 0.19 Mgal/d. Stream discharge is measured periodically at 17 streamflow measurement sites on the 11 streams in the Pine Barrens. (USGS)
W88-03028

DIVISIONS OF POTENTIAL FRACTURE PERMEABILITY BASED ON DISTRIBUTION OF STRUCTURES AND LINEAMENTS, IN SEDIMENTARY ROCKS OF THE ROCKY MOUNTAINS-HIGH PLAINS REGION, WESTERN UNITED STATES,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. E. Cooley.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4091, 1986. 1 sheet (map), 16 ref.

Descriptors: *Fracture permeability, *Aquifer systems, *Groundwater movement, *Structural geology, *Geologic joints, *High Plains Aquifer, *Regional Aquifer Systems Analysis, *Arizona, *Colorado, *Kansas, *Nebraska, *New Mexico, *Oklahoma, *South Dakota, *Texas, *Utah, *Wyoming, *Landsat imagery, Geohydrology, Groundwater availability, Sedimentary rocks, Satellite technology.

Fractures--joints and faults--affect the movement of fluids in rocks. Fracture permeability is important in sedimentary rocks that otherwise transmit water slowly, particularly limestone, dolomite, and fine-grained sandstone. A map of fracture traces may be used in assessing the spatial distribution of groundwater. The principal map in this report (scale 1:2,500,000) shows geologic structures and lineaments that affect the distribution of fracture traces in the sedimentary rocks of the High Plains and some adjacent areas. Potential fracture permeability is indicated on the map by 5 divisions, ranging from division 1 (smallest) to division 5 (largest potential fracture permeability). Geologic structure was the basis for delineating division boundaries. Generally, rocks in structurally uplifted areas and near conspicuous lineaments are more extensively fractured and have greater secondary permeability than rocks of structural basins. (USGS)
W88-03029

HYDROGEOLOGIC CONDITIONS AND SALINE-WATER INTRUSION, CAPE CORAL, FLORIDA, 1978-81,
Geological Survey, Fort Meyers, FL. Water Resources Div.
D. J. Fitzpatrick.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4231, 1986. 31 p, 19 fig, 9 ref.

Descriptors: *Saline water intrusion, *Tidal effects, *Water levels, *Drawdown, *Florida, Vertical flow, Navigation canals, Boreholes, Geohydrology, Cape Coral, Lee County, Hawthorn Formation.

The upper limestone unit of the intermediate aquifer system, locally called the upper Hawthorn aquifer, is the principal source of freshwater for Cape Coral, Florida. The aquifer has been contaminated with saline water by downward intrusion from the surficial aquifer system and by upward intrusion from the Floridan aquifer system. Much of the intrusion has occurred through open wellbores where steel casings are short or where casings have collapsed because of corrosion. Saline-water contamination of the upper limestone unit due to downward intrusion from the surficial aquifer is most severe in the southern and eastern parts of Cape Coral; contamination due to upward intrusion has occurred in many areas throughout Cape Coral. Intrusion is amplified in areas of heavy water withdrawals and large water-level declines. (USGS)
W88-03032

HYDROGEOLOGY AND SIMULATION OF WATER FLOW IN STRATA ABOVE THE BEARPAW SHALE AND EQUIVALENTS OF EASTERN MONTANA AND NORTHEASTERN WYOMING,
Geological Survey, Helena, MT. Water Resources Div.
W. R. Hotchkiss, and J. F. Levings.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4281, 1986. 72 p, 34 fig, 7 tab, 91 ref.

Descriptors: *Computer models, *Geohydrology, *Groundwater movement, *Montana, *Wyoming, Model studies, Groundwater, Northern Great Plains, Powder River basin, Bull Mountains basin, Williston basin.

The Powder River, Bull Mountains, and Williston basins of Montana and Wyoming were investigated to understand the geohydrology and subsurface water flow. Rocks were separated into: Fox Hills-lower Hell Creek aquifer (layer 1), upper Hell Creek confining layer (layer 2), Tullock aquifer (layer 3), Lebo confining layer (layer 4), and Tongue River aquifer (layer 5). Aquifer transmissivities were estimated from ratios of sand and shale and adjusted for kinematic viscosity and compaction. Vertical hydraulic conductance per unit area between layers was estimated. Potentiometric surface maps were drawn from limited data. A three-dimensional finite-difference model was used for simulation. Five stages of simulation decreased and standard error of estimate for hydraulic head from 135 to 110 feet for 739 observation nodes. The resulting mean transmissivities for layers 1-5 were 443, 191, 374, 217, and 721 sq ft/d. The corresponding mean vertical hydraulic conductances per unit area between the layers were simulated; they ranged from 0.000140 to 0.0000150. Mean annual recharge across the study area was about 0.26 percent of average annual precipitation. Large volumes of interlayer flow indicate the vertical flow may be significant. (USGS)
W88-03033

EVALUATION OF SIX METHODS FOR ESTIMATING MAGNITUDE AND FREQUENCY OF PEAK DISCHARGES ON URBAN STREAMS IN NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2A.
W88-03036

AVAILABILITY OF WATER FOR IRRIGATION IN THE SOUTH FORK SOLOMON RIVER VALLEY, WEBSTER RESERVOIR TO

WACONDA LAKE, NORTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
R. D. Burnett.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4064, 1986. 89 p, 19 fig, 6 tab, 11 ref, 11 plates.

Descriptors: *Computer models, *Groundwater movement, *Base flow, *Kansas, Recharge, Discharge, Withdrawals, Transient flow models, Water yield, Recharge, South Fork Solomon River valley.

The availability of surface water for irrigation in the South Fork Solomon River valley, Kansas, has become less reliable in recent years. Consequently, irrigation wells have been installed to supplement surface-water supplies. These events have prompted a study, made in cooperation with the U.S. Bureau of Reclamation and the Kansas Geological Survey, to develop a model of the stream aquifer system to gain more understanding of the hydrology and groundwater hydraulics. The alluvial aquifer, which extends over an area of about 100 square miles, has saturated thicknesses ranging from a few feet to about 50 feet. Recharge to the aquifer is principally from precipitation and from seasonal losses in irrigation canals and laterals. Discharge from the aquifer is principally to the river and by seasonal pumpage from wells. A transient numerical flow model was applied to evaluate the stream aquifer systems. The model was calibrated by comparing measured and simulated potentiometric surfaces in the alluvial aquifer and by comparing measured and simulated potentiometric surfaces in the alluvial aquifer and by comparing measured and simulated base flow in the South Fork Solomon River from March 1970 to January 1979. A model simulation indicated that pumpage could be continued at the 1978 rate through the year 2000 if recharge from streamflow diversion was equal to the 1970-78 rate. (USGS)
W88-03039

TRENDS IN MUNICIPAL-WELL INSTALLATIONS AND AQUIFER UTILIZATION IN SOUTHEASTERN MINNESOTA, 1880-1980,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 4B.
W88-03042

STATISTICAL EVALUATION OF EFFECTS OF IRRIGATION ON CHEMICAL QUALITY OF GROUND WATER AND BASE FLOW IN THREE RIVER VALLEYS IN NORTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03043

ALTITUDE AND CONFIGURATION OF THE WATER TABLE IN THE HIGH PLAINS AQUIFER OF KANSAS, 1975,
Geological Survey, Garden City, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03045

POTENTIOMETRIC SURFACES OF THE COASTAL PLAIN AQUIFERS OF SOUTH CAROLINA, PRIOR TO DEVELOPMENT,
Geological Survey, Columbia, SC. Water Resources Div.
W. R. Aucott, and G. K. Speiran.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4208, 1985. 5 sheets (map), 7 fig, 32 ref.

Descriptors: *Groundwater, *Potentiometric levels, *Coastal Plains, *South Carolina, Groundwater movement, Groundwater levels, Piezometric head, Maps, Hydrologic data.

Characteristics of the Coastal Plains aquifers of South Carolina are being studied as a part of the Regional Aquifer Systems Analysis program of the U.S. Geological Survey. A framework has been developed to best represent the hydrology of the Coastal Plain aquifers by dividing them into a system of five aquifers. This framework includes a surficial aquifer consisting of coastal terrace deposits, a limestone and stratigraphically equivalent sand aquifer of Eocene age, and three sand aquifers of Cretaceous age. This report presents a general description of the aquifer framework, potentiometric maps for the aquifers of Eocene and Cretaceous age prior to development, and a general description of the flow system prior to development. In the lower Coastal Plain, flow in the aquifer of Eocene age is generally perpendicular to the coast but is almost parallel to the coast in the aquifers of Cretaceous age. (USGS)
W88-03047

DAKOTA AQUIFER NEAR PUEBLO, COLORADO: FAULTS AND FLOW PATTERNS,
Geological Survey, Lakewood, CO. Water Resources Div.
E. R. Banta.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4186, 1985. 23 p, 10 fig, 1 tab, 23 ref.

Descriptors: *Flow patterns, *Groundwater barriers, *Geologic fractures, *Groundwater movement, *Colorado, Groundwater recharge, Transmissivity, Lithology.

The Dakota Sandstone and the underlying Purgatoire Formation consisting of the Glencairn Shale and Lytle Sandstone Members form a board outcrop at the southeastern margin of the Canon City Embankment. The two formations form the Dakota aquifer, which supplies water to many domestic, stock, and irrigation wells in addition to a few municipal wells in the 12-township study area. Five large faults and several small faults, all apparently of high angle, are found in the study area. Analysis of water levels and water quality shows that parts of some of these faults restrict the flow of groundwater in the Dakota aquifer. Lithology of the rocks, particularly in the Dakota Sandstone and in the Glencairn Shale Member, is extremely variable. The lithology appears to affect the flow regime, possibly by determining how a particular segment of a fault affects flow. (USGS)
W88-03048

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE LITTLE BEAR CREEK AREA, MOORHEAD COAL FIELD, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 4C.
W88-03049

HYDROLOGY OF LAKE JUNE IN WINTER, HIGHLANDS COUNTY, SOUTH-CENTRAL FLORIDA,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 2H.
W88-03053

GEOHYDROLOGY OF THE IRONDEQUOIT CREEK BASIN NEAR ROCHESTER, NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
R. M. Yager, P. J. Zarriello, and W. M. Kappel.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4259, 1985. 7 sheets, 7 plates (maps), 16 ref.

Descriptors: *Geohydrology, *Glacial geology, *Groundwater, *New York, Soil permeability, Recharge, Maps, Monroe County, Irondequoit Creek, Lake Ontario.

Geohydrologic information on the area within and surrounding the Irondequoit Creek basin near Rochester, in north-central New York, is presented on five maps at 1:24,000 scale indicating: (1) locations of glacial geomorphic features, (2) surficial geology, (3) soil permeability, (4) potentiometric-surface altitude and directions of groundwater movement, and (5) groundwater recharge and flow patterns. Also included are 20 geologic sections showing statigraphic relationships, aquifer composition, and depth to bedrock. Each map includes a short text and a list of references. Results indicate that groundwater within the basin flows northward to Irondequoit Bay and Lake Ontario and that the groundwater drainage system is considerably smaller than the overlying surface drainage area. These maps, based on available records and published data, depict the location of major recharge areas, relative rates of recharge, and the direction and rates of groundwater flow within the basin for use in aquifer management. (USGS)
W88-03055

POTENTIOMETRIC SURFACES OF NOVEMBER 1982 AND DECLINES IN THE POTENTIOMETRIC SURFACES BETWEEN THE PERIOD PRIOR TO DEVELOPMENT AND NOVEMBER 1982 FOR THE COASTAL PLAIN AQUIFERS OF SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
W. R. Aucott, and G. K. Speiran.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4215, 1985. 7 sheets (maps), 9 fig, 27 ref.

Descriptors: *Groundwater, *Potentiometric levels, *Coastal Plains, *South Carolina, Drawdown, Groundwater movement, Piezometric head, Groundwater levels.

Characteristics of the Coastal Plains aquifer of South Carolina are being studied as a part of the Regional Aquifer Systems Analysis program of the U.S. Geological Survey. A framework has been developed to best represent the hydrology of the State by dividing the aquifers into a system of five aquifers. This framework includes a surficial aquifer consisting of coastal terrace deposits, a limestone and stratigraphically equivalent sand aquifer of Eocene age, and three sand aquifers of Cretaceous age. (USGS)
W88-03056

WATER-QUALITY CONDITIONS AND AN EVALUATION OF GROUND- AND SURFACE-WATER SAMPLING PROGRAMS IN THE LIVERMORE-AMADOR VALLEY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03058

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE BATH AREA, LOWER COHOCTON RIVER, STEUBEN COUNTY, NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
T. S. Pagano, D. B. Terry, M. L. Shaw, and A. W. Ingram.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4095, 1985. 7 plates (map), 5 ref.

Descriptors: *Groundwater, *Aquifers, *Groundwater movement, *Geohydrology, *Groundwater levels, *New York, Geologic mapping Hydrogeology, Infiltration capacity, Land use, Well yield, Steuben County, Soil permeability, Bath valley-fill aquifer, Geohydrology.

The Bath valley-fill aquifer, southern New York, composed of outwash, ice-contact, and ice-disintegration sand and gravel, is highly productive and is in many areas in hydraulic contact with the Co-

hocton River. Potential well yields range 50 to more than 1,000 gallons per minute. Most of the aquifer is under shallow water-table conditions and vulnerable to surface contamination. Thickness ranges from 20 to 40 feet. Buried aquifers are present locally. The aquifer system underlies an area containing only a few small communities and therefore is not heavily pumped. Geohydrologic data are compiled on six maps at 1:24,000 scale and on a sheet of geologic sections. The maps depict surficial geology, soil-infiltration capacity, potentiometric surface, aquifer thickness, well yields, and land use. This map report set is one in a series of four that depict selected aquifers in Wester New York. It supplements a series that is being done by the U.S. Geological Survey in cooperation with State agencies. The maps are based largely on published reports, data filled in several State agencies, and some additional field data collection. (USGS)
W88-03060

DELINEATING RECHARGE AREAS FOR STRATIFIED-DRIFT AQUIFERS IN CONNECTICUT WITH GEOLOGIC AND TOPOGRAPHIC MAPS,
Geological Survey, Hartford, CT. Water Resources Div.
E. H. Handman.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 83-4230, 1986. 39 p, 12 fig, 4 tab, 41 ref.

Descriptors: *Groundwater pollution, *Aquifer systems, *Connecticut, Groundwater, Groundwater movement, Aquifers, Recharge, Natural recharge, Induced infiltration, Groundwater basins, Surface-groundwater relationships, Unconsolidated aquifers, Glacial aquifers, Water pollution sources, Path of pollutants, Stratified drift, Aquifer protection, Drainage-area maps.

Stratified-drift aquifers, the major source of large quantities of groundwater in Connecticut, are recharged principally by (1) precipitation that infiltrates the land surface overlying the aquifer and percolates downward to the saturated zone, (2) subsurface inflow of groundwater from adjacent till-and-bedrock uplands, and (3) surface water that infiltrates through streambed or lake-bottom sediments. Infiltration of surface water commonly occurs where pumping wells lower then water table sufficiently to reverse the normal hydraulic gradient between the aquifer and nearly surface-water body to which it is hydraulically connected. In most parts of Connecticut, groundwater circulation in unconsolidated deposits is probably confined within each basin drained by a major perrennial stream. Where this is the case, surface water and groundwater drainage divides commonly coincide, and areas that contribute recharge under natural conditions and under conditions of development can be estimated using geologic and topographic maps. Large stratified-drift aquifers that extend across surface water drainage, divides underlie most of north-central Connecticut and parts of the Quinnipiac and Farmington River basins. Definition of recharge areas for these aquifers is more complicated and requires more detailed hydrologic information. (USGS)
W88-03062

WATER RESOURCES APPRAISAL OF THE CAMP SWIFT LIGNITE AREA, CENTRAL TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03064

EFFECTS OF HIGH-RATE WASTEWATER SPRAY DISPOSAL ON THE WATER-TABLE AQUIFER, HILTON HEAD ISLAND, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 5E.
W88-03065

ANNOTATED BIBLIOGRAPHY OF THE GEOLOGY, HYDROLOGY, AND GEOTHERMAL RESOURCES OF THE JEMEZ MOUNTAINS AND VICINITY NORTH CENTRAL NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 10C.
W88-03068

GROUNDWATER LEVELS IN ALASKA, 1983,
Geological Survey, Anchorage, AK. Water Resources Div.
J. O. Brunett.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-56, 1986. 225 p, 190 fig.

Descriptors: *Water levels, *Aquifers, *Alaska, Wells, Data collections, Groundwater data.

Groundwater level data in Alaska are summarized for the 1983 water year for observation wells at which levels are either recorded continuously or measured intermittently. For wells at which water levels are measured semi-annually, 10-year summaries are presented. Water levels for 153 observation wells are shown on graphs and locations of the wells are shown on accompanying maps. The following information is given for each well: location, owner, type of aquifer, depth and casing information, type of measurement, altitude datum, period of record, and extremes for the period. (USGS)
W88-03069

GEOHYDROLOGIC DATA ALONG THE SALT-GILA AQUEDUCT OF THE CENTRAL ARIZONA PROJECT IN MARICOPA AND PINAL COUNTIES, ARIZONA,
Geological Survey, Phoenix, AZ. Water Resources Div.
B. L. Wallace, B. M. Wrege, and H. H. Schumann.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-236, 1986. 49 p, 23 fig, 21 tab.

Descriptors: *Subsidence, *Groundwater depletion, *Arizona, *Aquifer compaction, Groundwater, Drill holes, Well data, Water levels, Hazards.

The U.S. Geological Survey, in cooperation with the U.S. Bureau of Reclamation, is conducting an investigation of land subsidence and earth fissures along the Salt-Gila aqueduct to identify hazard zones and to provide design data for the Central Arizona Project aqueducts. Thirty-three test holes were drilled along the Salt-Gila aqueduct of the Central Arizona Project in Maricopa and Pinal Counties. Included in the report are maps showing locations of test holes and vertical extensometer sites, records of test holes, and tables and graphs showing water-level measurements. (USGS)
W88-03070

HYDROLOGIC AND MICROMETEOROLOGIC DATA FROM AN UNSATURATED ZONE STUDY AT A LOW-LEVEL RADIOACTIVE WASTE BURIAL SITE NEAR BARNWELL, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
K. F. Dennehy, and P. B. McMahon.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-476, 1985. 32 p, 2 fig, 8 tab, 6 ref.

Descriptors: *Hydrologic data, *Water data, *Micrometerology, *Radioactive waste disposal, *Groundwater movement, Tensiometers, Thermocouples, Tracers, Solar radiation, Wind, Soil temperature, Soil-moisture tension, Backfill material, Undisturbed sediments, Waste burial trenches, Soil-moisture specific conductance, Low-level radioactive waste site.

Two years of selected hydrologic and micrometeorologic data collected at a low-level radioactive waste burial site near Barnwell, South Carolina are available on magnetic tape in card-image format. Hydrologic data include daily measurements of soil-moisture tension, soil-moisture specific conductance, and soil temperature at four monitoring site locations. Micrometeorlogic data include hourly measurements for the following parameters: dry- and wet-bulb temperatures, soil temperatures, soil heat flux, wind speeds and direction, incoming and reflected short-wave solar radiation, incoming and emitted long-wave radiation, net radiation and precipitation. (USGS)
W88-03071

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT AND VICINITY, FLORIDA, MAY 1986,
Geological Survey, Orlando, FL. Water Resources Div.
G. R. Schiner.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-408, 1986. 1 plate (map).

Descriptors: *Potentiometric surface, *Groundwater, *Florida, *Maps, Hydrologic aspects, Aquifers, Geohydrology, St. Johns River Water Management District.

This map shows the potentiometric surface of the Upper Floridan aquifer in the St. Johns River Water Management District and vicinity, Florida, for May 1986. The Upper Floridan aquifer is the principal source of potable water in the area. Water level measurements were made on approximately 1,000 wells and on several springs. The potentiometric surface is shown mostly by 5-foot contour intervals. In the Fernandina Beach area of Nassau County, a 30-ft. interval is used to show a deep cone of depression. The potentiometric surface ranged from 125 feet above sea level in Polk County to 75 feet below sea level in Nassau County. Water levels in most key wells ranged from 1 to 9 feet below the May average in response to the lack of recharge from rainfall and an attendant increase in pumpage. Many levels in the district were equal to or lower than the below average levels of May 1985. Declines of about a foot from May 1985 levels were common in the eastern half of the district. However, the largest declines from May 1985 levels, as much as 7 to 9 feet, were mostly in well fields along the coastline. Levels in many wells approached, and in a few wells exceeded, record lows. (USGS)
W88-03072

WATER RESOURCES ACTIVITIES IN NEW YORK 1985-86,
Geological Survey, Albany, NY. Water Resources Div.
A. J. Finch, and S. M. Durocher.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-146, 1986. 56 p, 1 fig, 95 ref.

Descriptors: *Hydrologic data, *Geohydrology, *Hydrogeologic studies, *New York, Groundwater, Aquifers, Water quality, Streamflow, Data collections.

The U.S. Geologic Survey conducts water-resources investigations and hydrologic data collection in all states to provide the data and understanding needed for optimum use and management of the nation's surface water and groundwater. This is achieved through jointly funded programs with state, county, municipal, and other Federal agencies. The Geological Survey conducted 37 water resources investigations in New York during 1985-86, several of which are continuous. This report describes each project in terms of problems, objectives, progress to date, and future plans and gives the period of funding, project chief, principal coordinating agency, field location, and completed reports. It also lists all reports resulting from the Survey's water resources studies in New York during 1982-86. (USGS)
W88-03073

GROUNDWATER-QUALITY DATA FOR PICATINNY ARSENAL, NEW JERSEY, 1958-85,

Geological Survey, Trenton, NJ. Water Resources Div.
B. P. Sargent, J. W. Green, P. T. Harte, and E. F. Vowinkel.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-58, 1986. 66 p, 2 fig, 1 plate, 5 tab, 18 ref.

Descriptors: *Water quality, *Picatinny Arsenal, *New Jersey, Hydrologic data, Groundwater, Organic compounds.

The water resources of Picatinny Arsenal in northern New Jersey are described using the results of 1,129 analyses of groundwater, including 522 determinations of inorganic constituents and 607 determinations of organic constituents. Water samples were collected from 56 wells on the site from 1958 through 1985. Of these wells, 50 are screened in stratified drift aquifers and 6 are in bedrock. Samples were collected and analyzed by a total of four agencies: one State, one Federal, and two private. Of the 1,129 samples, 51 were collected and analyzed by the U.S. Geological Survey. The data on inorganic constituents exhibit much variability. Specific conductance ranges from 40 to 2,150 microsiemens per centimeter at 25 degrees C, pH ranges from 2.9 units to 10 units, and dissolved solids ranges from 51 to 1,210 milligrams per liter. Trace elements that display wide variations in concentration ranges are iron (<2 to 540,000 micrograms/L), manganese (<1 to 55,000 micrograms/L), and zinc (<3 to 1,900 micrograms/L). The organic compounds with the widest variations in concentration are: 1,2-transdichloroethylene (<1 to 542 micrograms/L), tetrachloroethylene (<1 to 386 micrograms/L), 1,1,1-trichloroethane (<1 to 1,780 micrograms/L), and trichloroethylene (<1 to 25,000 micrograms/L). (USGS)
W88-03075

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GW IN CHAMBERS, LIBERTY, AND MONTGOMERY COUNTIES, TEXAS, 1980-84,
Geological Survey, Austin, TX. Water Resources Div.
J. F. Williams, L. S. Coplin, C. E. Ranzau, and W. B. :ind.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-57, 1986. 37 p, 3 fig, 11 tab, 6 ref.

Descriptors: *Groundwater, *Texas, Drillers logs, Water levels, Chemical analyses, Water quality, Chambers County, Liberty County, Montgomery County, Data collection.

Information on major new water wells in Chambers, Liberty, and Montgomery Counties was compiled by the U.S. Geological Survey from 1980 through 1984. This report presents the results of the hydrologic data collection on new large-capacity and other selected wells, including well location and completion data, drillers' logs of the strata penetrated, water levels, and chemical quality of the produced water. These water-well data are supplementary to similar data on older wells in these counties and descriptive evaluations of the groundwater resources which have been published previously. (USGS)
W88-03076

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUNDWATER IN BRAZORIA, FORT BEND, AND WALLER COUNTIES, TEXAS, 1980-84,
Geological Survey, Austin, TX. Water Resources Div.
J. F. Williams, C. E. Ranzau, W. G. Lind, and L. S. Coplin.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-68, 1986. 51 p, 3 fig, 12 tab.

Descriptors: *Groundwater, *Texas, Drillers logs, Water levels, Chemical analyses, Water quality, Data collections, Brazoria County, Fort Bend County, Waller County.

Information on major new water wells in Brazoria, Fort Bend, and Waller Counties was compiled by the U.S. Geological Survey from 1980 through 1984. This report presents the results of the hydrologic data collection on new large-capacity and other selected wells, including well location and completion data, drillers' logs of the strata penetrated, water levels, and chemical quality of the produced water. These water-well data are supplementary to similar data on older wells in these counties and descriptive evaluations of the groundwater resources which have been published previously. (USGS)
W88-03077

APPROXIMATE WATER-LEVEL CHANGES IN THE CHICOT AND EVANGELINE AQUIFERS, 1977-85 AND 1984-1985 AND MEASURED COMPACTION, 1973-85, IN HARRIS AND GALVESTON COUNTIES, TEXAS,
Geological Survey, Houston, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03080

WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN WYOMING, FISCAL YEAR 1985,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03081

GEOPHYSICAL WELL LOG DATA FOR STUDY OF WATER FLOW IN FRACTURES NEAR MIRROR LAKE, NEW HAMPSHIRE,
Geological Survey, Denver, CO. Water Resources Div.
F. L. Paillet.
Available from USGS, OFSS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-340, 1985. 27 p, 13 fig, 2 tab, 14 ref.

Descriptors: *Borehole geophysics, *Fracture permeability, *New Hampshire, Acoustic televiewer, Acoustic waveform logging.

Four closely spaced boreholes were drilled through approximately 20 meters of till into schist bedrock near Mirror Lake, West Thornton, New Hampshire. The site was selected for borehole geophysical research because it is included in a detailed groundwater study where the effects of flow in fractures on flow in overlying drift deposits is being studied. Three of the boreholes are approximately 100 meters in depth, and the fourth is approximately 230 meters in depth. All four boreholes were logged with caliper, acoustic, gamma, single-point-resistivity, and acoustic televiewer logs. Fracture sets dipping approximately 45 degrees to the east were detected in all four boreholes. Two sets of deeper fractures were detected near the bottom of the deepest borehole. Acoustic waveform logs were obtained in all boreholes using three different source frequencies, 34, 15, and 5 kilohertz, for future comparison with surface to borehole seismic data. (USGS)
W88-03083

DISSOLVED-SELENIUM DATA FOR WELLS IN THE WESTERN SAN JOAQUIN VALLEY, CALIFORNIA, FEBRUARY TO JUNE 1985,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W88-03084

GROUNDWATER DATA, GREEN RIVER BASIN, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03089

WATER-LEVEL MEASUREMENTS FOR THE COASTAL PLAIN AQUIFERS OF SOUTH CAROLINA PRIOR TO DEVELOPMENT,
Geological Survey, Columbia, SC. Water Resources Div.
W. R. Aucott, and G. K. Speiran.
Available from USGS, OFSS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-803, 1984. 36 p, 1 fig, 2 tab, 21 ref.

Descriptors: *Groundwater, *Potentiometric levels, *Coastal Plains, *South Carolina, Piezometric head, Groundwater levels, Hydrologic data.

Characteristics of the Coastal Plain aquifers of South Carolina are being studied as a part of the Regional Aquifer Systems Analysis (RASA) program of the U.S. Geological Survey. This report presents tabulations of basic well information and water-level measurements for the Coastal Plain aquifers of South Carolina representing water levels prior to man-made development. These measurements were used in compiling regional potentiometric maps for the Coastal Plain aquifers. (USGS)
W88-03090

HYDROLOGIC DATA FROM ROAN CREEK AND PARACHUTE CREEK BASINS, NORTHWESTERN COLORADO,
Geological Survey, Grand Junction, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03092

HYDROGEOLOGIC FRAMEWORK OF THE NEW JERSEY COASTAL PLAIN,
Geological Survey, Trenton, NJ. Water Resources Div.
O. S. Zapecza.
Available from USGS, OFSS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-730, 1984. 61 p, 5 fig, 4 tab, 24 pl, 58 ref.

Descriptors: *Aquifers, *Confining beds, *New Jersey, *Geohydrology, *Coastal plains, Groundwater, Subsurface mapping, Cross-sections, Stratigraphy, Borehole geophysics.

Results are presented of a water-resources-oriented subsurface mapping program within the Coastal Plain of New Jersey. The occurrence and configuration of 15 regional hydrogeologic units are defined based primarily on the interpretation of borehole geophysical data. The nine aquifers and six confining beds are composed of unconsolidated clay, silt, sand, and gravel and range in age from Cretaceous to Quaternary. Electric and gamma-ray logs from more than 1,000 Coastal Plain wells were examined. Of these, interpretive data for 302 sites, selected for log depth, quality, and distribution, were used to prepare structure contour and thickness maps for each aquifer, and a thickness map for each confining bed. These maps, along with 14 hydrogeologic sections, show the geometry, lateral extent, and vertical and horizontal relationships among the 15 hydrogeologic units. (USGS)
W88-03093

IOWA GROUNDWATER MONITORING PROGRAM,
Geological Survey, Iowa City, IA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03094

REGRESSION MODELING OF GROUNDWATER FLOW,
Geological Survey, Lakewood, CO. Water Resources Div.
R. L. Cooley, and R. L. Naff.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-180, 1985. 450 p, 46 fig, 13 tab, 26 ref.

Descriptors: *Statistical models, *Regression analysis, *Aquifer characteristics, *Groundwater models, *Groundwater movement, *Parameter estimation, Least square method, Inverse problem.

Nonlinear multiple regression methods are developed to model and analyze groundwater flow systems. Complete descriptions of regression methodology as applied to groundwater flow models allow scientists and engineers engaged in flow modeling to apply the methods to a wide range of problems. Organization of the text proceeds from an introduction that discusses the general topic of groundwater flow modeling, to a review of basic statistics necessary to properly apply regression techniques, and then to the main topic: exposition and use of linear and nonlinear regression to model groundwater flow. Statistical procedures are given to analyze and use the regression models. A number of exercises and answers are included to exercise the student on nearly all the methods that are presented for modeling and statistical analysis. Three computer programs implement the more complex methods. These three are a general two-dimensional, steady-state regression model for flow in an anisotropic, heterogeneous porous medium, a program to calculate a measure of model nonlinearity with respect to the regression parameters, and a program to analyze model errors in computed dependent variables such as hydraulic head. (USGS)
W88-03095

GROUNDWATER CONDITIONS IN UTAH, SPRING OF 1985,
Geological Survey, Salt Lake City, UT. Water Resources Div.
R. L. Seiler.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. Utah Division of Water Resources Cooperative Investigations Report 25, 1985. 84 p, 42 fig, 3 tab, 2 ref.

Descriptors: *Groundwater, *Water use, *Utah, Water levels, Groundwater withdrawals, Water supply, Water resources development.

Estimated total withdrawal of water from wells in Utah during 1984 was about 614,000 acre-feet. Of the total withdrawal, about 329,000 acre-feet was for irrigation, about 225,000 acre-feet was for industry and public supply, and the remaining 60,000 acre-feet was for domestic and stock use. The total 1984 withdrawal was about 14,000 acre-feet more than that estimated for 1983, but was about 193,000 acre-feet less than the average annual withdrawal estimated for 1974-83. The decrease from the 1974-83 annual average resulted from generally above-average precipitation and streamflow in 1984, and therefore, a smaller need for supplemental groundwater supplies. Groundwater levels in most parts of Utah generally were higher during February-March 1985 than during February-March 1984. This was the third consecutive year that net rises of groundwater levels were recorded in most parts of the State. The rises were attributed chiefly to increased recharge from the generally above-average precipitation and streamflow in 1984, and to the relatively small withdrawal of water from wells during the year compared to the 1974-83 annual average withdrawal. (USGS)
W88-03098

GROUNDWATER HYDROLOGY OF ELK RIVER BASIN, WEST VIRGINIA,
Geological Survey, Charleston, WV. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03099

GROUNDWATER RESOURCES OF THE RAYVILLE-DELHI AREA, NORTHEASTERN LOUISIANA,
Geological Survey, Alexandria, LA. Water Resources Div.
K. J. Covay.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. Louisiana Water-Resources Technical Report No. 7, 1985. 22 p, 6 fig, 8 tab, 15 ref.

Descriptors: *Groundwater, *Groundwater resources, *Water quality, *Aquifers, *Mississippi River alluvial aquifer, *Cockfield aquifer, *Richland Parish, *Louisiana, Hydraulic conductivity, Transmissivity, Chemical analysis, Dissolved solids, Chloride, Iron, Infiltration, Sparta aquifer, Rayville, Delhi.

Principal aquifers in the Rayville-Delhi area are in the Mississippi River valley alluvium of Pleistocene age and the Cockfield Formation of Eocene age. The Sparta Sand Eocene age is of lesser importance and contains freshwater only in the extreme western part of the project area. The Mississippi River alluvial aquifer contains freshwater throughout most of the area. The water is very hard and iron concentrations range from 300 to 3,000 micrograms per liter. However, large quantities of water are available; yields of several thousand gallons per minute are possible. The Cockfield aquifer contains freshwater except in the extreme eastern part of the area where Cockfield sand units contain salty water. Except where water in the Cockfield is modified by infiltration from the overlying alluvial aquifer, the water generally is soft and iron concentrations range from 20 to 770 micrograms per liter. Hydraulic conductivities of the sand units range from 30 to 55 feet per day, and optimum well yields are a few hundred gallons per minute. The Cockfield aquifer is best suited for development of small to moderate supplies. (USGS)
W88-03100

HYDROGEOLOGY, DIGITAL SOLUTE-TRANSPORT SIMULATION, AND GEOCHEMISTRY OF THE LOWER CRETACEOUS AQUIFER SYSTEM NEAR BALTIMORE, MARYLAND,
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03101

MARYLAND SPRINGS--THEIR THERMAL AND CHEMICAL CHARACTER,
Geological Survey, Towson, MD. Water Resources Div.
E. G. Otton, and J. T. Hilleary.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. Maryland Geological Survey Report Investigations 42, 1985. 151 p, 16 fig, 16 tab, 59 ref.

Descriptors: *Springs, *Geohydrology, *Energy conversion, *Chemical properties, *Maryland, Thermal springs, Warm springs, Trace elements, Groundwater movement, Piedmont province, Appalachian province, Hagerstown valley.

The flow and temperature of 100 springs in an area of 4,500 square miles, comprising the Piedmont and Appalachian provinces of Maryland were investigated. The flow of these springs ranges from less than 1 to nearly 10,000 gallon per minute. The largest flow is from the Potomac Blue Spring in the Potomac River valley near Cumberland, Maryland. The flow and temperature of most springs range widely during an annual cycle. Temperature variations of 76 individual Maryland springs ranged from 1.5 to 18.9 C. The maximum temperature recorded was 19.9 C. Mean annual water temperature usually is within 1 to 2 C of the local mean annual air temperature. Measurements of flow and temperature of a large spring in Washington County show that an energy transfer involving a reduction of the spring's mean temperature by 5 C would yield 1,320,000 watts per hour. Maryland springs represent a large potential source of thermal energy. Chemical analyses of the water from 24 springs show that most of the water is calcium-magnesium-bicarbonate water, or water of a mixed type. Nearly all of the water is of a chemical character suitable for most uses. Concentrations of the trace elements aluminum, cadmium, chromium, copper, lead, lithium, mercury, nickel, silver, and lead are all below the U.S. Environmental Protection Agency's maximum allowable levels. (USGS)
W88-03102

EFFECTS OF GRAVITATIONAL AND EARTHQUAKE FORCES ON THE STABILITY OF THE SOUTH FORK CASTLE CREEK BLOCKAGE IN THE MOUNT ST. HELENS AREA, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 8D.
W88-03108

GEOLOGIC FRAMEWORK OF THE GROUNDWATER FLOW SYSTEM IN JURASSIC AND CRETACEOUS ROCKS, NORTHERN GREAT PLAINS,
Geological Survey, Reston, VA. Water Resources Div.
L. O. Anna.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Professional Paper 1402-B, 1986. 36 p, 18 plates, 190 ref.

Descriptors: *Geohydrology, *Geology, *Structural geology, *South Dakota, *Stratigraphy, *Groundwater movement, *Montana, *North Dakota, *Wyoming, *Powder River Basin, *Williston Basin, *Regional Aquifer System Analysis, Great Plains, Geologic control, Sedimentary structures.

The recent resurgence of energy development in the Northern Great Plains will place new and increased demands on groundwater development. Water from Jurassic and Cretaceous rocks might supply part of the needed water. Geologic framework of the groundwater flow system in the Northern Great Plains is divided into two parts: structural and statigraphic. Jurassic and Cretaceous rocks are divided into six chronostratigraphic intervals. Thickness and sedimentological variations of each interval shows distinct patterns or lineaments. These lineaments may reflect paleogeographic and paleostructural trends. The tectonic and sedimentation model most appropriate for the lineaments and the orientations of these lineaments can best be explained by a horizontal-style stress system. This system created the structural configuration of grabens, half gradens, and horsts, initiated in Precambrian time, that influenced the position of depositional environments, subsequently influenced the lateral and vertical distribution of sediments, and was enhanced by eustatic changes in sea level. Orientation of tensional and compressional structural features and lineaments is predictable under this style of stress system. Tensional features, oriented east-west and northeast-southwest, enhance secondary porosity or permeability; thus, they become partial conduits for groundwater flow. Compressional features, oriented generally north-south and northwest-southeast, decrease porosity or permeability, and become barriers or partial barriers to groundwater flow. (USGS)
W88-03109

HYDROGEOLOGIC FRAMEWORK OF THE FLORIDAN AQUIFER SYSTEM IN FLORIDA AND IN PARTS OF GEORGIA, ALABAMA, AND SOUTH CAROLINA,
Geological Survey, Atlanta, GA. Water Resources Div.
J. A. Miller.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Professional Paper 1403-B, 1986. 91 p, 28 fig, 33 plates, 1 tab, 164 ref.

Descriptors: *Geohydrology, *Geohydrologic units, *Aquifer systems, *Carbonate rocks, *Hydrologic maps, *Florida, *Georgia, *Alabama, *South Carolina, Subsurface mapping, Geologic units, Coastal Plains.

The Floridan aquifer system of the southeastern United States consists of a thick sequence of carbonate rocks, mostly Paleocene to early Miocene in age, that are hydraulically connected in varying degrees. The aquifer system consists of a single layer updip and is divided downdip into the Upper and Lower Floridan aquifers, separated by one of seven middle confining units. The rocks that comprise the Florida, its upper and lower confining units, and a surficial aquifer have been separated into seven chronostratigraphic units whose tops and bottoms, like those of the major permeability units within the aquifer system do not coincide everywhere with formation tops and bottoms. Subsurface data show that modifications are necessary

in the current stratigraphic nomenclature applied to Eocene and Paleocene rocks: changes are proposed. Major geologic structures have extensively affected the thickness and type of sediment deposited in the eastern Gulf Coast. Such structures have also affected groundwater flow in the Floridan aquifer system, as shown on potentiometric surface maps of the system. Permeability variations within the Floridan are complex and result from a combination of original depositional conditions, diagenesis, large and small geologic structures, and dissolution of carbonate rocks or evaporite deposits. (USGS)
W88-03110

HYDROLOGY OF THE FLORIDAN AQUIFER SYSTEM IN WEST-CENTRAL FLORIDA,
Geological Survey, Reston, VA. Water Resources Div.
P. D. Ryder.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Professional Paper 1403-F, 1985. 63 p, 46 fig, 5 tab, 97 ref.

Descriptors: *Geohydrology, *Computer models, *Floridan aquifer system, *Regional analysis, *Florida, Potentiometric level, Aquifer characteristics, Southwest Florida Water Management District.

A computer flow model was calibrated to approximate predevelopment and 1976 flow conditions in a multilayered aquifer system in 10,600 square miles in west-central Florida. The Floridan aquifer system is confined in most of the study area. The upper part of the system, the fresh water bearing upper Floridan aquifer, consists of carbonate rocks ranging up to 1,800 feet thick. The upper Floridan aquifer is the chief source for large withdrawals and natural springflow in the study area. Daily springflows within the study area have averaged about 2.3 billion gallons. By 1976, waterwell development accounted for an additional average outflow of about 950 million gallons per day. Calibrated transmissivities for the upper Floridan aquifer range from less than 17,000 (offshore where the aquifer thins) to nearly 13,000,000 sq. ft. per day (near large springs). Under steady-state conditions, total recharge to the system was estimated to be 3,200 million gallons per day; of this, 64 percent was discharged as springflow, 30 percent was discharged from wells, and 6 percent was discharged as diffuse upward leakage. Model simulation of hypothetical well fields illustrates the large difference in the hydraulics of the flow system in selected parts of the study area. The simulation also demonstrates the applicability of modeling techniques to water management and planning. (USGS)
W88-03111

AQUEOUS GEOCHEMISTRY OF THE BRADYS HOT SPRINGS GEOTHERMAL AREA, CHURCHILL COUNTY, NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 2K.
W88-03114

ESTIMATING STREAM-AQUIFER INTERACTIONS IN COAL AREAS OF EASTERN KANSAS USING STREAMFLOW RECORDS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2A.
W88-03116

EVALUATING STRATEGIES FOR GROUNDWATER CONTAMINANT PLUME STABILIZATION AND REMOVAL,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5G.
W88-03118

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER, WEST-CENTRAL FLORIDA, SEPTEMBER 1986,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03126

GROUNDWATER LEVELS IN THE ALLUVIAL AQUIFER IN EASTERN ARKANSAS, 1985,
Geological Survey, Little Rock, AR. Water Resources Div.
M. Plafcan.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-242, 1986. 29 p, 2 fig, 1 tab, 8 ref.

Descriptors: *Groundwater level, *Alluvial aquifers, *Mississippi River Valley, *Arkansas, Mississippi alluvial plain, Wells.

This report, prepared by the U.S. Geological Survey in cooperation with the Arkansas Soil and Water Conservation Commission, the U.S. Soil Conservation Service and local Conservation Districts, contains groundwater level measurements in 485 wells tapping the Mississippi River Valley alluvial aquifer of eastern Arkansas. The measurements were made by district Soil Conservation Service personnel during 1985. The purpose of this report is to provide these data to other State and Federal agencies as well as to private landowners. The shallowest pre-pumping water levels occurred in Clay, Independence, and Mississippi County where most water levels were within 20 feet of land surface. Counties where water levels of 100 feet below land surface or greater were measured included: Arkansas, Lonoke, Poinsett, and Prairie. Water-level measurements made during the post-pumping (recovery) season averaged 3.65 feet less than those made during the pre-pumping season. A comparison of pre-pumping water-level measurements made in 1984 to those made in 1985 shows an average rise of 1.0 foot within the area (Edds and Spencer, 1985). (USGS)
W88-03127

HYDROLOGIC RECONNAISSANCE AND SUMMARY OF EXISTING DATA ON SURFACE AND GROUNDWATER RESOURCES IN THE MISSOURI RIVER VALLEY IN WOODBURY AND MONONA COUNTIES, IOWA, 1985,
Geological Survey, Iowa City, IA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03129

HYDROLOGIC DATA FROM NAVAL OIL SHALE RESERVES, PARACHUTE CREEK BASIN, NORTHWESTERN COLORADO, WATER YEARS 1982-83,
Geological Survey, Grand Junction, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03131

WATER QUALITY DATA FOR THE GROUNDWATER NETWORK IN EASTERN BROWARD COUNTY, FLORIDA, 1983-1984,
Geological Survey, Miami, FL. Water Resources Div.
B. G. Waller, and F. L. Cannon.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-313, 1986. 68 p, 1 fig, 2 tab, 7 ref.

Descriptors: *Water quality, *Groundwater quality, *Network design, *Biscayne aquifer, *Florida, Inorganic compounds, Nutrients, Broward County, Water-quality network.

During 1983-84, groundwater from 63 wells located at 31 sites throughout eastern Broward County, Florida, was sampled and analyzed to determine baseline water quality conditions. The physical and chemical parameters analyzed included field measurements (pH and temperature), physical characteristics (color, turbidity, and specific conductance), major inorganic ions, nutrients, (nitrogen, phosphorus and carbon), selected metals, and total phenolic compounds. Groundwater samples were collected at the end of the dry season (April) and during the wet season (July and September). These data are tabulated, by well, in this report. (USGS)
W88-03133

SELECTED PUBLICATIONS ON THE WATER RESOURCES OF VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
For primary bibliographic entry see Field 10C.
W88-03135

WATER-RESOURCES DATA FOR THE MOUNT SHASTA AREA, NORTHERN CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03138

CURRENT WATER RESOURCES ACTIVITIES IN ALABAMA, FISCAL YEAR 1986,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03140

GEOLOGIC AND GEOPHYSICAL CHARACTERISTICS OF FRACTURE ZONES IN THE FLORIDAN AQUIFER,
University of South Florida, Tampa. Dept. of Geology.
M. T. Stewart.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-156999/AS. Price codes: A06 in paper copy, A01 in microfiche. Florida Water Resources Research Center, Gainesville, Technical Publication 88. 1985. 93 p, 15 tab, 25 fig, 37 ref. Contract No. 14-08-0001-G899. Project No. USGS G899-04; UF Project 125747011.

Descriptors: *Florida, *Karst hydrology, *Geohydrology, *Floridan aquifer, Aquifers, Fracture traces, Karst, Groundwater, Applied geophysics.

Fracture traces in the carbonate bedrock of west-central Florida can have very distinctive geophysical responses. The responses over the fracture zones are associated with increased depth and thickness of the geoelectrical layers, microgravity lows, resistivity lows, and conductivity highs. Closely-spaced vertical electrical soundings yield the most information on the stratigraphy and geometry of the fracture zone and aid in interpretation of the character of the fractured limestone. The tri-potential method detected isolated fractures not directly associated with the principal fracture zone. The geologic character of the two fractures zones is very different. The Cross Bar Ranch feature is a deep, V-shaped depression in the limestone 25m deep and 90m wide. The Crystal River Quarry feature is a linear ridge 15m high and 60m wide with a central depression 5-7m deep and 10m wide. The small, V-shaped central depression is probably the major fracture zone, but fractures are present on the adjacent ridges as well. Although photolinears often represent vertical fracture zones, many hydrogeologically important fractures may exist that are not expressed on aerial photos or the land surface. It is recommended that multiple geophysical methods be used when determining the location of the fracture zone within the zone defined by the photolinear or when prospecting for unmapped fractures. (USGS)
W88-03152

SIMPLIFIED APPROACH TO REGIONAL MULTILAYERED AQUIFER ANALYSIS,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
M. M. Aral.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-164167/AS. Price codes: A05 in paper copy, A01 in microfiche. Report No. ERC 02-85. Environmental Resources Center, Georgia Institute of Technology,

Atlanta. August 1985. 65 p, 1 tab, 1 fig, 31 ref. Project No. USGS G-900-02.

Descriptors: *Groundwater movement, *Finite element analysis, *Multilayer aquifers, *Mathematical models, Aquifer management, Water levels, Regional analysis.

In order to effectively monitor and manage aquifers subjected to artificial recharge as well as increased pumping demands, it is necessary to analyze their hydrodynamic response. Several mathematical numerical models were developed to accomplish this purpose on a regional scale for single layer aquifers. A regional two-dimensional flow analysis was formulated using finite element techniques for multilayer aquifers. The advantages of using finite element analysis for aquifer analysis becomes evident when attempting to model irregular boundaries and variable inputs such as recharge, pumping and field properties in multilayer systems. Numerical solutions are also presented, which when compared with known analytical solutions show the accuracy levels expected and also some limitations of the model. This study is a preliminary step toward the ultimate goal of predicting and monitoring water quality and quantity in a multilayer aquifer system. (Aral-GA Inst. Tech.)
W88-03153

COASTAL-A DISTRIBUTED HYDROLOGIC SIMULATION MODEL FOR LOWER COASTAL PLAIN WATERSHEDS IN GEORGIA,
Georgia Univ., Athens. Dept. of Geography.
For primary bibliographic entry see Field 2E.
W88-03154

EVALUATION OF METHODS FOR ESTIMATION OF AQUIFER RECHARGE FROM PRECIPITATION ON SEMI-ARID LANDS,
Idaho Univ., Moscow. Water Resources Research Inst.
G. S. Johnson, C. E. Brockway, and A. Coiner.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-157054/AS. Price codes: A03 in paper copy, A01 in microfiche. Completion Report. September 1985. 24 p, 7 fig, 3 tab, 10 ref. Contract No. 14-08-0001-G903. Project No. USGS G903-07.

Descriptors: *Groundwater recharge, *Rainfall infiltration, *Effective precipitation, *Recharge, *Idaho, Groundwater management.

Precipitation falling on semi-arid, non-irrigated lands may represent a significant percentage of total aquifer recharge in areas such as the eastern Snake River Plain in southern Idaho. Direct measurement of precipitation recharge is usually not feasible due to large areal concerns and non-uniformity of controlling conditions. A water budget may be applied in several forms, but often lacks the accuracy necessary. Inaccuracy of frequently used basic data such as precipitation is a primary deficiency. It was estimated that measured annual precipitation on the eastern Snake River Plain is in error by 15 to 20 percent. Application of sophisticated recharge estimation models is not justified due to errors in primary data. (Idaho WRRI)
W88-03162

PREDICTING THE ADVECTIVE FLOW VELOCITY IN A CONFINED AQUIFER USING A SINGLE WELL TRACER TEST,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W88-03171

DISCRETE KERNEL MODEL FOR SIMULATION OF MULTILAYERED AQUIFERS,
Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
T. H. Illangasekare.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-170453/AS. Price codes: A05 in paper copy, A01 in microfiche. Completion Report, Louisiana Water Resources Research Institute. 1985. 72 p, 9 fig, 2 tab, 3 append, 33 ref. Project No. USGS G909-03.

Descriptors: *Aquifer models, *Groundwater movement, *Multilayered aquifers, *Computer models, Groundwater management, Water conservation, Geohydrology, Mathematical models.

The design and development of a special management oriented groundwater model for the simulation of multilayered aquifers are presented. Multilayered aquifers consist of water bearing aquifer layers separated by sufficiently permeable confining layers which permit significant leakage flow. The discrete kernel approach for groundwater modeling is used as the basic technique. The approach is based on the classical solution of partial differential equations using Green's function method. Once Green's function solution to a linear partial differential equation is known the response to any type of excitation can be obtained by convoluting the excitations with Green's function. The three dimensional flow in the multilayered aquifer is simulated using a quasi-three dimensional flow model. The flow in each aquifer layer is modelled as two dimensional flow in the horizontal direction. The flow in the confining aquitard layers is assumed vertical. A discrete kernel formulation was developed to simulate these assumed flow conditions. The kernels for the aquifer layers are generated by solving the two dimensional saturated groundwater flow equations using an implicit finite difference scheme. The kernels for the aquitard are generated by solving the one dimensional saturated flow equation using the Galerkin finite element method. The multiaquifer simulation model uses these kernel coefficients to compute the transient head distribution in the aquifer and aquitard layers and the leakage flux. The model has the capability to compute the head with a higher resolution in any specified sub-regions of a large regional aquifer system. (Illangasekare-LA. St. U.)
W88-03179

BASE LINE DATA ANALYSIS OF A DEVELOPING GEOTHERMAL SYSTEM, BOISE, IDAHO,
Boise State Univ., ID. Dept. of Geology and Geophysics.
C. J. Waag, and S. H. Wood.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-198074/AS. Price codes: A03 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, Moscow, Completion Report. September 1985. 25 p, 7 fig, 19 ref. Project No. USGS G903-09.

Descriptors: *Geothermal resources, *Idaho, *Baseline studies, Groundwater reservoirs, Geophysics, Hydrologic data, Groundwater potential, Aquifer characteristics.

Calculated aquifer transmissivities in the Boise Warm Springs Water District portion of the geothermal system range from 3500-25,000 gals/day/ft. Withdrawals during the 1984-1985 heating season stabilized drawdown at the pumpbowls and water levels approached stability in observation wells as distant as 1675 ft (507.6 m). In this near steady-state condition, recharge and water from storage beyond the observation wells provided a maximum Q of 840 gpm. (Waag-IWWRI)
W88-03190

OPTIONS FOR MANAGING UNDERGROUND STORAGE TANKS,
Virginia Water Resources Research Center, Blacksburg.
For primary bibliographic entry see Field 5G.
W88-03224

REGULATION REVIEW FOR UNDERGROUND STORAGE TANKS,
Wiley and Wilson, Inc., Lynchburg, VA.
For primary bibliographic entry see Field 6E.
W88-03225

PREDICTION OF HEAVY METAL LEACHING RATES FROM STABILIZED/SOLIDIFIED HAZARDOUS WASTES,
New Hampshire Univ., Durham. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W88-03239

ENHANCEMENT OF BIODEGRADATION OF ALCOHOLS IN GROUNDWATER SYSTEMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W88-03255

THREE SCREENING TESTS FOR THE EVALUATION OF GROUNDWATER QUALITY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W88-03260

THEORETICAL ASSESSMENT OF CASING STORAGE EFFECTS WHEN PUMP SAMPLING A PARTIALLY PENETRATING BOREHOLE,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Groundwater Research.
For primary bibliographic entry see Field 8B.
W88-03273

GROUNDWATER IN COLUMBIA,
A. Lobo-Guerrero, and Y. Gilboa.
Hydrological Sciences Journal HSJODN, Vol. 32, No. 2, p 161-178, June 1987. 6 fig, 1 tab, 8 ref.

Descriptors: *Aquifers, *Groundwater, *Aquifer characteristics, Columbia, Groundwater reservoirs, Tropical regions, Groundwater availability, Groundwater budget, Groundwater potential, Groundwater recharge.

In tropical Columbia, where 75% of groundwater exploitation is concentrated in two limited areas, successful agricultural ventures proved its economic value. It is therefore imperative to assess the development possibilities of this almost untouched resource to complement surface water in irrigation and water supply projects, and in some cases to replace contaminated sources. The major aquifer units in the country and their state of exploitation and approximate recharge values are described. (Author's abstract)
W88-03275

GROUNDWATER DATA FROM THE SAN MIGUEL RIVER BASIN, SOUTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
D. J. Ackerman, and T. Brooks.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-191, 1985. 19 p, 2 fig, 1 pl, 4 tab, 1 ref.

Descriptors: *Data collections, *Water quality, *Colorado, Springs, Wells, San Miguel River basin.

Hydrologic data were collected from 36 wells and 80 springs in the San Miguel River basin from 1977 to 1979. Depth to water was measured for 22 wells and discharges were measured for 53 springs. Chemical analyses for water samples collected from 23 wells and 25 springs indicated larger dissolved solids concentrations in bedrock water samples than in alluvial water samples. Drillers' records obtained from the Colorado State Engineer's Office for 86 wells indicate generally larger yields from wells completed in alluvium than in bedrock. (USGS)
W88-03300

WATER-RESOURCES ACTIVITIES IN UTAH BY THE U.S. GEOLOGICAL SURVEY, JULY 1, 1985 TO JUNE 30, 1986,
Geological Survey, Salt Lake City, UT. Water Resources Div.

For primary bibliographic entry see Field 7B.
W88-03302

HYDROGEOLOGIC DATA FOR THE DAKOTA AQUIFER SYSTEM IN NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
M. J. Ellis.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-526, 1986. 100 p, 6 fig, 4 tab, 3 ref.

Descriptors: *Hydrogeologic data, *Nebraska, *Dakota aquifer system, *Groundwater data, Water resources data, Aquifers, Data collections.

Data utilized in preparing an interpretive hydrogeologic report on the Dakota aquifer system in Nebraska are summarized. The study area is a 370,000 sq mi area that includes all of Kansas and Nebraska and parts of Arkansas, Colorado, Missouri, New Mexico, Oklahoma, and Texas. The broad objective for each Regional Aquifer-System analysis (RASA) study is to assemble geologic, hydrologic, and geochemical information; to analyze and develop an understanding of the hydrogeologic system; and to develop predictive capabilities that will contribute to effective management of groundwater resources. The Central Midwest RASA project includes the study of the major regional aquifers that occur in the stratigraphic interval between the Precambrian surface and the top of the Great Plains aquifer system. The Dakota aquifer system in Nebraska, which is the equivalent of the Great Plains aquifer system, can best be defined as those sandstones and shales occurring in the stratigraphic interval between the base of the Cretaceous system and the top of the first major sandstone bed below the Cretaceous Greenhorn Limestone. This aquifer systems underlies approximately 94 percent of the State. Distribution of data sites is not uniform across the State. Although the aquifer systems underlies all or parts of 88 of Nebraska's 93 counties, hydrogeologic data on the Dakota are available only for 83 counties. Individual data sites were selected on the basis of the completeness and representativeness of data for the site and to provide an adequate areal distribution of data needed to describe the hydrogeology of the aquifer system. Four tables are used to summarize hydrogeologic data. (USGS)
W88-03306

WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN NEW-MEXICO--FISCAL YEAR 1986,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03309

WATER RESOURCES ACTIVITIES IN ILLINOIS, 1985,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03311

ESTIMATING AVERAGE BASE FLOW AT LOW-FLOW PARTIAL-RECORD STATIONS ON SOUTH-SHORE STREAMS OF LONG ISLAND, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
H. T. Buxton.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4240, 1985. 32 p, 6 fig, 4 tab, 22 ref.

Descriptors: *Base flow, *Surface-groundwater relations, *New York, *Log Flow, Regression analysis, Long Island, Heohydrology.

Base flows of the 29 major streams in southeast Nassau and southwest Suffolk Counties, New York, were statistically analyzed to discern the correlation among flows of adjacent streams. Concurrent base-flow data from a partial-record and a nearby continuous-record station were related; the data were from 1968-75, a period near hydrologic equilibrium on Long Island. The average base flow at each partial-record station was estimated from a regression equation and average measured base flow for the period at the continuous-record stations. Regression analyses are presented for the 20 streams with partial-record stations. Average base flow of the nine streams with a continuous record totaled 90 cu ft/sec; the predicted average base flow for the 20 streams with a partial record was 73 cu ft/sec (with a 95% confidence interval of 63 to 84 cu ft/sec.) Results indicate that this method provides reliable estimates of average low flow for streams such as those on Long Island, which consist mostly of base flow and are geomorphically similar. (USGS)
W88-03312

EFFECTS OF SANITARY SEWERS ON GROUNDWATER LEVELS AND STREAMS, NASSAU AND SUFFOLK COUNTIES, NEW YORK. PART 2--DEVELOPMENT AND APPLICATION OF SOUTHWEST SUFFOLK COUNTY MODEL,
Geological Survey, Syosset, NY. Water Resources Div.
H. T. Buxton, and T. E. Reilly.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 83-4209, 1985. 39 p, 18 fig, 3 tab, 29 ref.

Descriptors: *Groundwater, *Model studies, *Surface-groundwater relation, *New York, Long Island, Geohydrology, Sanitary sewers, Wastewater disposal.

By 1990, sanitary sewers in Nassau County Sewage Disposal Districts 2 and 3 and Suffolk County Southwest Sewer District will discharge to the ocean 140 cu ft of water/sec that would otherwise be returned to the groundwater system through septic tanks and similar systems. To evaluate the effects of this loss on groundwater levels and streamflow, the U.S. Geological Survey developed a groundwater flow model that couples a fine-scale subregional model to a regional model of larger scale. The regional model generates flux boundary conditions for the subregional model, and the subregional model provides detail in the area of concern. Results indicate that the water table will decline by as much as 8 ft along the Suffolk-Nassau county line, with effects decreasing eastward. Base flow is predicted to decrease by as much as 73% in a stream along the county line, but this effect will decrease to zero just east of the sewered area. This report is one of a series describing the predicted hydrologic effects of sewers in southern Nassau and southwest Suffolk Counties. (USGS)
W88-03313

CONCEPTUAL GROUNDWATER-QUALITY MONITORING NETWORK FOR SAN FERNANDO VALLEY, CALIFORNIA,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03318

HYDROLOGY OF COAL-LEASE AREAS NEAR DURANGO, COLORADO,
Geological Survey, Grand Junction, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03321

WATER RESOURCES OF YANKTON COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
E. F. Bugliosi.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4241, 1986. 41 p, 21 fig, 3 tab, 29 ref.

Descriptors: *Groundwater, *Surface waters, *Water quality, *Aquifer characteristics, *South Dakota, Recharge, Hydrologic data, Yankton County.

The major surface-water sources in Yankton County, South Dakota are Lewis and Clark Lake, Marindahl and Beaver Lakes, and the Missouri and James Rivers. The James River has an average flow of 375 cu ft/sec and the Missouri River at Yankton has an average flow of 26,410 cu ft/sec. Major aquifers are the Dakota, the Niobrara, and the Lower James-Missouri glacial outwash. Depth to the Dakota aquifer, which underlies the entire county, ranges from about 300 to more than 500 ft below land surface. Wells completed in this artesian aquifer below altitudes of 1,260 ft will flow from 3 to 60 gallons/min at the land surface when properly constructed. Recharge is by subsurface inflow from the west. The water is a calcium sulfate type and is suitable in most cases for domestic, livestock, and irrigation uses. The Niobrara aquifer, which underlies the northeast and southwest parts of the county, may be under artesian or water-table conditions. Well yields vary but usually are suitable only for domestic use. Recharge to the northeast part of the aquifer is from precipitation infiltrating the overlying glacial deposits. The southwest part receives recharge as subsurface inflow from the west and from precipitation. The water is a magnesium sulfate type. The Lower James-Missouri aquifer underlies almost 50% of the county. Water in the aquifer is present under both artesian and water-table conditions. Wells can be expected to yield at least 1,000 gallons/min. Recharge is from subsurface inflow from the north and west, the Missouri River to the south, and from precipitation. The water is predominantly calcium sodium sulfate type, and specific conductance and hardness average 1,910 micromhs and 870 milligrams/L, respectively. (USGS)
W88-03322

INVESTIGATION OF POSSIBLE EFFECTS OF SURFACE COAL MINING ON HYDROLOGY AND LANDSCAPE STABILITY IN PART OF THE POWDER RIVER STRUCTURAL BASIN, NORTHEASTERN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 4C.
W88-03325

HYDROLOGIC MAPS OF THE PRICE 30 X 60 MINUTE QUADRANGLE, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03328

SOURCES OF WATER AND NITROGEN TO THE WIDEFIELD AQUIFER, SOUTHWESTERN EL PASO COUNTY, COLORADO,
Geological Survey, Pueblo, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03330

WATER RESOURCES OF CLALLAM COUNTY, WASHINGTON: PHASE I REPORT,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03331

TECHNIQUE FOR PREDICTING GROUNDWATER DISCHARGE TO SURFACE COAL MINES AND RESULTING CHANGES IN HEAD,
Geological Survey, Urbana, IL. Water Resources Div.
L. S. Weiss, D. L. Galloway, and A. L. Ishii.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4156, 1986. 65 p, 36 fig, 5 tab, 36 ref, 5 append.

Descriptors: *Mine drainage, *Discharge, *Subsurface drainage, *Strip mines, *Groundwater, *Model studies, Aquifers, Water levels, Predictive methods.

Changes in seepage flux and head (groundwater level) from groundwater drainage into a surface coal mine can be predicted by a technique that considers drainage from the unsaturated zone. The user applies site-specific data to precalculated head and seepage-flux profiles. Groundwater flow through hypothetical aquifer cross sections was simulated using the U.S. Geological Survey finite-difference model, VS2D, which considers variably saturated two-dimensional flow. Conceptual models considered were (1) drainage to a first cut, and (2) drainage to multiple cuts, which includes drainage effects of an area surface mine. Dimensionless head and seepage flux profiles from 246 simulations are presented. Step-by-step instructions and examples are presented. Users are required to know aquifer characteristics and to estimate size and timing of the mine operation at a proposed site. Calculated groundwater drainage to the mine is from one excavated face only. First cut considers confined and unconfined aquifers of a wide range of permeabilities; multiple cuts considers unconfined aquifers of higher permeabilities only. The technique, developed for Illinois coal-mining regions that use area surface mining and evaluated with an actual field example, will be useful in assessing potential hydrologic impacts of mining. Application is limited to hydrogeologic settings and mine operations similar to those considered. Fracture flow, recharge, and leakage are nor considered. (USGS)
W88-03333

GROUNDWATER MOVEMENT IN THE UPPER GLACIAL AQUIFER IN THE MANORVILLE AREA, TOWN OF BROOKHAVEN, LONG ISLAND, NEW YORK, IN NOVEMBER 1983,
Geological Survey, Syosset, NY. Water Resources Div.
D. A. Eckhardt, and E. J. Wexler.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4035, 1986. 12 p, 4 fig, 3 tab, 10 ref.

Descriptors: *Groundwater movement, *Water-table gradient, *Glacial aquifers, *Water table, *New York, Aquifers, Town of Brookhaven, Suffolk County, Long Island.

Water levels in 52 wells near the Manorville scavenger-waste disposal facility in the Town of Brookhaven were measured in November 1983 to determine the direction and gradients of groundwater flow in the upper glacial aquifer. Groundwater moves south-southeastward (S22 degrees E) from the groundwater divide, about 6 miles north of the facility, to discharge points near East Moriches and beneath Moriches Bay. The hydraulic gradient beneath the disposal facility is 6.5 ft/mi (0.0012 foot/foot), and the rate of horizontal flow is 0.9 to 1.7 ft/day. Vertical movement of groundwater since closure of the disposal facility in 1982 is probably negligible because the vertical gradients are small and the upper glacial aquifer is anisotropic. During operation of the facility, however, groundwater mounding may have developed beneath the unlined settling basins, which could have induced downward movement of water in the upper glacial aquifer. (USGS)
W88-03336

GROUND WATER AND POTENTIAL FOR ARTIFICIAL RECHARGE IN THE WESTERN PART OF THE U.S. MARINE CORPS BASE, TWENTYNINE PALMS, CALIFORNIA, 1982-83,
Geological Survey, Sacramento, CA. Water Resources Div.
J. P. Akers.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4119, 1986. 18 p, 5 fig, 3 tab, 16 ref.

Descriptors: *Artificial recharge, *Groundwater, *Groundwater basins, *Groundwater management, *California, Groundwater level, Groundwater potential, Groundwater storage, Water quality, Twentynine Palms.

A gravity survey indicates that sedimentary deposits in the Deadman Lake area of the U.S. Marine Corps Base at Twentynine Palms, California, are as much as 10,500 ft thick. These deposits fill an ancient valley in the bedrock complex. Over the past 30 years in Surprise Spring subbasin, water levels have changed little in the Ames Dry Lake area and have declined an average of about 85 ft in three Marine Corps Base supply wells near Surprise Spring. Water levels in the same time span in Deadman subbasin have remained virtually unchanged. Water quality in the base supply wells has remained virtually unchanged since the wells were drilled in 1952-53 and 1978. Original storage of groundwater suitable for domestic use in the top 200 ft of saturated sediments in Surprise Spring subbasin is estimated at 810,000 acre-feet. About 60,000 acre-feet of this has been removed, mostly for use at the base, which leaves about 750,000 acre-feet of recoverable water of good quality. For planning purposes, a conservative figure is 300,000 acre-feet for storage in the Deadman subbasin, which contains water having fluoride concentrations greater than the U.S. Environmental Protection Agency's standards for drinking water. Three sites near the present well field seem favorable for recharging the groundwater system in the Surprise Spring basin. (USGS)
W88-03339

PRELIMINARY APPRAISAL OF GROUND WATER IN AND NEAR THE ANCESTRAL MISSOURI RIVER VALLEY, NORTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
G. W. Levings.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4138, 1986. 41 p, 10 fig, 8 tab, 18 ref.

Descriptors: *Groundwater, *Water quality, *Glacial aquifers, Observation wells, Hydrologic data, Data collections, Montana, Ancestral Missouri River valley, Medicine Lake, Dagmar, Westby.

A preliminary appraisal was conducted in and near the ancestral Missouri River valley in northeastern Montana to describe the groundwater resources and to establish a data base for the area. The data base then could be used for future evaluation of possible changes in water levels or water quality. In this area, consolidated aquifers are the Upper Cretaceous Fox Hills-lower Hell Creek aquifer and the overlying Paleocene Fort Union Formation. Unconsolidated aquifers are Pleistocene terrace gravel and glacial deposits and Holocene alluvial deposits. Aquifers are recharged by precipitation, infiltration of streamflow, and possibly leakage from lakes and potholes. Groundwater moves from topographically higher areas to the ancestral valley, then along the ancestral valley to the southwest. Water is discharged from aquifers by evapotranspiration, springs and seeps, movement directly into streams and lakes, and from pumping wells. Average well yields are greatest for irrigation wells completed in outwash gravel (886 gallons/min). Eighteen wells were completed in various aquifers to monitor potential long-term changes in water levels and water quality. Measured water levels declined about 2 ft. or less during the study (1982-85). Chemical analysis of groundwater samples indicated that concentrations of some dissolved constituents exceeded U.S. Environmental Protection Agency standards for drinking water. (USGS)
W88-03340

METHODS FOR ESTIMATING LOW-FLOW STATISTICS FOR UNGAGED STREAMS IN THE LOWER HUDSON RIVER BASIN, NY,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03343

GROUND-WATER CONDITIONS AND LEACHATE MOVEMENT NEAR TWO CHEMICAL-WASTE SITES IN OSWEGO COUNTY, NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03344

RECONNAISSANCE OF THE WATER RESOURCES AND POTENTIAL EFFECTS OF MINING OF THE JOLIET-FROMBERG COAL TRACT, CARBON COUNTY, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 4C.
W88-03345

CONNECTICUT OBSERVATION WELLS - GUIDELINES FOR NETWORK MODIFICATION,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03347

GROUND-WATER AVAILABILITY AND WATER QUALITY AT SOUTHBURY AND WOODBURY, CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
D. L. Mazzaferro.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4221, 1986. 105 p, 28 fig, 27 tab, 40 ref.

Descriptors: *Groundwater availability, *Hydrologic models, *Water quality, *Glacial aquifers, *Streamflow depletion, *Trichloroethane, Alluvial aquifers, Aquifer management, Groundwater management, Groundwater movement, Groundwater resources, Organic compounds, Groundwater development, Organohalide compounds, Connecticut, Pomperaug River, Southbury, Woodbury.

Increases in population and commercial and industrial development during the past 20 years have increased the demand for water in the Towns of Southbury and Woodbury, Connecticut. The stratified-drift aquifer, underlying much of the Pomperaug River valley, is the most practical source for additional large supplies. The yield of the aquifer was evaluated with a two-dimensional, digital flow model. The model was constructed with hydrologic data from previous studies, and test boring logs, seismic profiles, water-level measurements, and other information collected during the present study. Simulations made with the calibrated model indicate that, with no pumpage, groundwater levels in the aquifer will fall about 4.6 ft below average during low-recharge (least-favorable) periods, and rise about 0.6 ft above average during high-recharge (most-favorable) periods. Simulated withdrawals from 10 wells indicate that from 5.0 to 8.8 million gallons/day are available as total recharge rates range from 21.4 to 36.1 inches/year. If these pumpages were consumed or exported from the basin, estimated average flow reductions of the Pomperaug River would range from 7.7 to 12.9 cu ft/sec. The quality of the water from the stratified-drift aquifer is generally excellent in most areas and meets State drinking-water standards. Chemical analyses of groundwater from 11 wells in the Middle Quarter area of Woodbury indicate that organohalide compounds are present. A maximum trichloroethane concentration of 260 micrograms/L has been reported and groundwater in the area is presently being monitored for organohalides. The water meets standards established by the State. Surface water samples collected at 7 sites in the study area meet the Connecticut drinking water standards for all constituents except coliform bacteria. Complete conventional treatment of surface water from some wells will be required to meet State drinking water standards relative to coliforms. (USGS)
W88-03348

MAPS OF THE BONSALL AREA OF THE SAN LUIS REY RIVER VALLEY, SAN DIEGO, CALIFORNIA; SHOWING GEOLOGY, HYDROLOGY, AND GROUND-WATER QUALITY,
Geological Survey, Laguna Niguel, CA. Water Resources Div.

For primary bibliographic entry see Field 7C.
W88-03349

OCCURRENCE OF GROUND-WATER AND POTENTIAL FOR SEAWATER INTRUSION, ISLAND COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03350

HYDROLOGIC EFFECTS OF WITHDRAWAL OF GROUND-WATER ON THE WEST FARGO AQUIFER SYSTEM, CASS COUNTY, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
C. A. Armstrong.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 83-4279, 1985. 28 p, 13 fig, 2 tab, 16 ref.

Descriptors: *Groundwater, *Aquifers, *Water levels, *Hydrographs, *Water-level fluctuations, *Data collections, *North Dakota, Water yield, Water resources data, Cass County.

The West Fargo area, an area of 230 sq mi in eastern Cass County, is underlain by glaciofluvial sand and gravel deposits that form the West Fargo aquifer system. The aquifer system contains about 131,300 million gallons of available groundwater in storage. Recharge to the aquifer system is estimated to be about 600 to 650 million gallons per year. Discharge in 1980 is estimated to have been 683 million gallons. Pumping from the West fargo aquifer system began in the latter part of the 19th century. No records of pumpage were kept in the early years, but pumpage has averaged 613 million gallons/year near West Fargo at least since 1968. Water levels, which were near or above land surface at West Fargo in 1869, have declined to as much as 121.7 ft below land surface in 1981. In areas of little or no pumpage, water levels have declined much less. The rate of water-level decline in an observation well in the West Fargo South aquifer was as low as 0.2 ft/year, but increased to a rate of 2.1 ft/yr from 1976 through 1981 due to an increase of the average annual pumping rate of about 59.9 million gallons at a well field about 5 miles north. Water in the aquifer system contains from 332 to 2,960 mgs/L of dissolved solids and 25 to 975 mgs/L of chloride ions. (USGS)
W88-03351

WASTEWATER MOVEMENT NEAR FOUR TREATMENT AND DISPOSAL SITES IN YELLOWSTONE NATIONAL PARK, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03352

WATER QUALITY OF STREAMS AND SPRINGS, GREEN RIVER BASIN--WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2K.
W88-03353

HYDROGEOLOGY OF AND POTENTIAL MINING IMPACTS ON STRIPPABLE LIGNITE AREAS IN THE DENVER AQUIFER, EAST-CENTRAL COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
N. E. Driver, and R. S. Williams.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4366, 1986. 39 p, 20 fig, 3 tab, 16 ref.

Descriptors: *Groundwater, *Lignite, *Geohydrology, *Denver basin, *Colorado, Hydrology, Denver aquifer.

This study describes the hydrogeology of and potential impacts of mining on strippable lignite areas in the Denver aquifer in the east-central Colorado plains. Strippable lignitic coal seams, 20 to 60 ft thick, are present in the Denver Formation. The Denver aquifer, the saturated part of the Denver Formation, is likely to be affected locally by surface mining of lignite. Transmissivity of the aquifer in the study area ranges from 145 to 1,000 mg/L to the northeast in the study area as, hydraulic head decreases from 6,600 to 5,400 ft. Distance-drawdown curves show the extent of water level drawdown near a dewatered surface mine. After reclamation of the lignite mine pit, flow through the lignite spoil pile may increase the dissolved solids concentrations in the Denver aquifer. This increase could occur, because, as water from rain and overland flow percolates through the newly-exposed rock surfaces in the spoil material, minerals from the overburden can be dissolved in the water, which then joins with water from the aquifer. This increase could locally change streams, springs, and alluvial and bedrock aquifers. (USGS)
W88-03354

HYDROLOGIC DESCRIPTION OF THE TAMARACK WILDLIFE AREA AND VICINITY, LOGAN COUNTY, COLORADO, AND SIMULATED EFFECTS OF POSSIBLE WATER-MANAGEMENT ACTIVITIES,
Geological Survey, Lakewood, CO. Water Resources Div.
A. W. Burns.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4014, 1985. 42 p, 20 fig, 7 tab, 14 ref.

Descriptors: *Surface-groundwater relationships, *Groundwater movement, *Colorado, Water temperature, Specific conductance, Model studies, Logan County, South Platte River basin, Tamarack Wildlife Area.

The stream-aquifer system of the Tamarack Wildlife Area and vicinity in Logan County, Colorado, is described using analyses of water level, water temperature, and specific conductance data. Correlation analysis indicated that water levels in the flood plain relate better to those in the river than those in the upgradient valley meadow. Water table surfaces showed that water moves parallel to the river with a small gradient toward the river. Water temperature data for the river had a large annual fluctuation. The temperature of well water from 0 feet below land surface had no fluctuation. The temperature of sloughs and shallow groundwater had intermediate fluctuations. Specific conductance data ranged from 264 microsiemens/cm at 25 C in sandhill wells to 1,540 microsiemens in the river. A groundwater flow model and simplified slough-temperature model showed that additional groundwater pumpage or lower river stage caused by upstream diversions would decrease groundwater inflow to the slough, with a corresponding water temperature decrease. A simulated artificial recharge project would increase groundwater inflow to the slough and increase water temperature in the slough. The simulation of a plan to pump groundwater to create wildlife-habitat ponds indicated that this would cause stream depletions each month, except during the nonpumping period, June through August. (USGS)
W88-03355

WATER-RESOURCES DATA NETWORK EVALUATION FOR MONTEREY COUNTY, CALIFORNIA--PHASE 1: SOUTH COUNTY,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03356

SURFICIAL GEOLOGY, STRUCTURE AND THICKNESS OF SELECTED GEOHYDROLOGIC UNITS IN THE COLUMBIA PLATEAU, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
B. W. Drost, and K. J. Whiteman.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4326, 1986. 11 plates, 5 tab, 10 ref.

Descriptors: *Geohydrology, *Groundwater movement, *Groundwater flow systems, *Aquifers, *Washington, *Maps, Columbia River Basalt Group Columbia Plateau.

A 2-1/2 year study of the Columbia Plateau in Washington was begun in March 1982 to define spatial and temporal variations in dissolved sodium in the Columbia River Basalt Group aquifers and to relate these variations to the groundwater system and its geologic framework. This report describes the geologic framework, including the vertical and areal extent of the major basalt units, interbeds, and overlying materials. Thickness and structure of the Grande Ronde, Wanapum, and Saddle Mountains Basalts, thickness of the interbeds between the Grande Ronde and Wanapum, and Wanapum and Saddle Mountains Basalts, and thickness of the overburden were mapped at a scale of 1:500,000. Information was compiled from 2,500 well records using chemical analyses of core or drill chips, geophysical logs, and driller's logs, in decreasing order of reliability. Surficial geology and surficial expression of structural features were simplified from published maps to provide maps with this information at the 1:500,000 scale. This report is intended to serve as a base for evaluating the distribution of dissolved sodium in basalt aquifers and as a base for future water resource studies. (USGS)
W88-03360

HYDROLOGY OF ISLAND FORD LAKE, HILLSBOROUGH COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 2H.
W88-03364

INDEX OF CURRENT WATER-RESOURCES ACTIVITIES IN OHIO, 1985,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03365

PRELIMINARY MAP SHOWING THE DIFFERENCE BETWEEN THE POTENTIOMETRIC SURFACES OF THE AQUIA AQUIFER OF APRIL 1979 AND SEPTEMBER 1982 IN SOUTHERN MARYLAND,
Geological Survey, Annapolis, MD. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03366

MAP SHOWING THE DIFFERENCE BETWEEN THE POTENTIOMETRIC SURFACES OF THE MAGOTHY AQUIFER OF SEPTEMBER 1975 AND SEPTEMBER 1982 IN SOUTHERN MARYLAND,
Geological Survey, Annapolis, MD. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03367

MAP SHOWING THE POTENTIOMETRIC SURFACE OF THE MAGOTHY AQUIFER IN SOUTHERN MARYLAND, SEPTEMBER 1982,
Geological Survey, Annapolis, MD. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03368

PRELIMINARY MAP SHOWING THE POTENTIOMETRIC SURFACE OF THE AQUIA AQUIFER IN SOUTHERN MARYLAND, SEPTEMBER 1982,
Geological Survey, Annapolis, MD. Water Resources Div.
F. K. Mack, J. C. Wheeler, and S. E. Curtin.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 83-929, 1983. 1 p, 1 fig.

Descriptors: *Maps, *Potentiometric levels, *Artesian aquifers, *Coastal plain, *Maryland, Wells, Coastal plain, Anne Arundel County, Prince Georges County, Calvert County, Charles County, St. Marys County, Cone of depression, Aquia aquifer, Groundwater levels.

A map was prepared that shows the potentiometric surface of the Aquia aquifer in southern Maryland in September 1982. The map is based on measurements from a network of 78 observation wells. The highest measured level of the potentiometric surface, 34 ft above sea level, was near the outcrop of the aquifer in a topographically high area of Anne Arundel County. The potentiometric surface slopes downward to the extensive cone of depression--much of it more than 40 ft below sea level--has developed around the well fields in the vicinity of Lexington Park. The network of observation wells was developed as part of the cooperative program between the U.S. Geological Survey, the Maryland Geological Survey, and the Maryland Energy Administration. (USGS)
W88-03369

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, SEPTEMBER 1984,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03372

CHEMICAL COMPOSITION OF GROUND WATER IN THE YUCCA MOUNTAIN AREA, NEVADA--AN UPDATE,
Geological Survey, Lakewood, CO. Water Resources Div.
L. V. Benson, and P. W. McKinley.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-484, 1985. 10 p, 5 fig, 1 tab, 4 ref.

Descriptors: *Water quality, *Water chemistry, *Radioactive waste disposal, *Nevada, Path of pollutants, Water composition, Yucca Mountain.

Fifteen wells in the Yucca Mountain area of southern Nevada have been sampled for chemical analysis. Samples were obtained by pumping water from the entire well bore (composite sample), and, in three instances, by pumping from one or more isolated intervals within a well bore. Sodium is the most abundant cation, and biocarbonate is the most abundant anion in all water samples. Samples from the Paleozoic carbonate aquifer penetrated by well UE-25p 1 contain higher relative concentrations of calcium and magnesium than samples from overlying volcanic tuffs. Values of the stable isotope concentrations of oxygen and hydrogen are relatively negative (light) and have deuterium excess values ranging from +5 to +10. The distribution of uncorrected radiocarbon ages of tuffaceous groundwater from samples within one kilometer of the exploratory block ranges from 12,000 to 18,500 years before present. Variation in the inorganic, stable, and radioactive isotope composition of samples indicates a significant degree of lateral and vertical chemical inhomogeneity in groundwater of the Yucca Mountain area. (USGS)
W88-03373

WATER-RESOURCES ACTIVITIES IN UTAH BY THE U.S. GEOLOGICAL SURVEY, JULY 1, 1984 TO JUNE 30, 1985,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03375

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO, 1984,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03376

GROUND-WATER DATA FOR THE ALLUVIAL, BURIED CHANNEL, BASAL PLEISTOCENE AND DAKOTA AQUIFER IN WEST-CENTRAL IOWA,
Geological Survey, Iowa City, IA. Water Resources Div.
P. K. B. Hunt, and D. L. Runkle.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 84-819, 1985. 168 p, 4 fig, 4 tab, 6 ref.

Descriptors: *Groundwater data collections, *Water quality data, *Iowa, *Aquifers, *Groundwater data, *Dakota aquifer, Water level, Lithologic logs, Borehole geophysics, Alluvium, Buried channels, Basal Pleistocene.

The purpose of this investigation was to determine the availability, quantity and quality of groundwater from three principal aquifers in West-Central Iowa, the alluvial, buried channel, Basal Pleistocene and the Dakota aquifers. Specific objectives were to: (1) determine the location, extent and the nature of these aquifers; (2) evaluate the occurrence and movement of groundwater, including the sources of recharge and discharge; (3) estimate the quantities of water stored in the aquifers; (4) estimate the potential yields of wells tapping the aquifers; (5) estimate the water use; and (6) describe the chemical quality of the groundwater. This report is the compilation of the data collected during the investigation and has the purpose of providing a reference for an interpretive report describing groundwater resources and a bedrock topography map of the study area. (USGS)
W88-03379

CLAY SIZED FRACTION AND POWERED WHOLE ROCK X-RAY ANALYSIS FROM ALLUVIAL BASIN DEPOSITS IN CENTRAL AND SOUTHERN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 2K.
W88-03382

RECORDS OF WELLS, TEST BORINGS AND SOME MEASURED GEOLOGIC SECTIONS NEAR THE WESTERN NEW YORK NUCLEAR SERVICE CENTER, CATTARAUGUS COUNTY, NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
M. P. Bergeron.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 83-682, 1985. 95 p, 1 fig, 4 tab, 2 plates, 32 ref.

Descriptors: *Well data, *Groundwater data, *Geologic data, *Waste disposal, *New York, *Radioactive wastes, Drillers logs, Well logs, Well records, Geologic sections, Western New York Nuclear Service Center, West Valley, Cattaraugus County, Fuel reprocessing.

The Western New York Nuclear Service Center (WNYNSC) is a 3,336-acre tract of land in northern Cattaraugus County, NY, about 30 mi south of Buffalo. In 1963, 247 acres within the WNYNSC was developed for a nuclear-fuel reprocessing plant and ancillary facilities, including (1) a receiving and storage facility to store fuel prior to reprocessing, (2) underground storage tanks for liquid high-level radioactive wastes from fuel reprocessing, (3) a low-level wastewater treatment plant, and (4) two burial grounds for shallow burial of solid radioactive waste. A series of geologic and hydrologic investigations was done as part of the initial development and construction of the facilities by numerous agencies during 1960-62; these produced a large quantity of well data, some of which are difficult to locate or obtain. This report is a compilation of well and boring data collected during this period. The data include records of 236 wells, geologic logs of 145 wells and 167 test borings, and descriptions of 20 measured geologic sections. Two oversized maps show locations of the reported data. (USGS)
W88-03384

IDENTIFICATION AND TABULATION OF GEOLOGICAL CONTACTS IN THE EDWARDS AQUIFER, SAN ANTONIO AREA, TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
T. A. Small.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 84-075, 1985. 54 p, 13 fig, 2 tab, 17 ref.

Descriptors: *Geologic formations, *Aquifers, *Texas, *Edwards aquifer, Geohydrology, Geological contacts, Gamma-ray logs, Electric logs.

Geological contacts were picked on logs of about 480 wells in the San Antonio area of the Edwards aquifer. The base of the Del Rio Clay is the most frequently picked because it is the top of the Edwards aquifer and also because it is easily identified on either gamma-ray or electric logs. Other important formation contacts identified were the Austin Group, the Eagle Ford Group, the Buda Limestone, and the Glen Rose Formation. These contacts were usually easy to identify on either gamma-ray or electric logs. (USGS)
W88-03385

COMPILATION AND ANALYSIS OF AQUIFER PERFORMANCE TESTS IN EASTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
T. B. Reed, and R. D. Burnett.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-200, 1985. 125 p, 6 fig, 5 tab, 25 ref.

Descriptors: *Aquifer testing, *Aquifer characteristics, *Kansas, Unconsolidated aquifers, Alluvial aquifers, Glacial aquifers, Unconfined aquifers, Confined aquifers, Leaky aquifers, Equus beds (stratigraphic).

Selected aquifer-test data from 36 counties in eastern Kansas were collected from numerous sources and publications in order to produce a documented compilation of aquifer tests in one report. Data were obtained chiefly from private consulting firms and from government agencies. Hydraulic properties determined included transmissivity, storage coefficient (where observation well was available), and in some cases hydraulic properties of a confining layer. The aquifers tested comprised three main types of rocks--consolidated rock deposits, glacial deposits, and alluvial deposits that include the 'Equus beds,' an extensive alluvial deposit in south-central Kansas. The Theis recovery equation and the Cooper-Jacob modified nonequilibrium equation were the two principal solution methods used. Other methods used included the Theis nonequilibrium equation, the Hantush-Jacob equation for a leaky confined aquifer, Hantush's modified leaky equation in which storage from a confining layer was considered, the Boulton's delayed-yield equation. Additionally, a specific-capacity method of estimating transmissivity was used when only a single drawdown value was available. (USGS)
W88-03386

JANUARY 1985 WATER LEVELS, AND DATA RELATED TO WATER-LEVEL CHANGES, WESTERN AND SOUTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
B. J. Dague.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-423, 1985. 162 p, 2 fig, 1 tab, 17 ref.

Descriptors: *Groundwater, *Water level changes, *Hydrologic data, *Kansas, Data collections.

Hydrologic data related to water level measurements made in approximately 1,350 observation wells in western and south-central Kansas are shown in this report. The measurements were made in mid-winter when pumping was minimal and water levels had recovered, for the most part, form the effects of pumping during the previous

irrigation season. Annual hydrologic data are provided for relating water level changes from a 'base-reference year' (predevelopment year), a year of abnormally high rainfall and minimum pumpage (1966 or 1974), and each of 7 consecutive years of measurement (1979-85). The 'base-reference year' is designated as 1940 for the southwestern area, 1944 for the south-central area, and 1950 for the northwestern, west-central, and Equus Beds areas. Data also are provided for relating the average annual water level changes, saturated thickness of the deposits, and percentage changes in saturated thickness. (USGS)
W88-03387

BASE FLOW MEASUREMENTS AT PARTIAL-RECORD SITES ON SMALL STREAMS IN SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03389

SUMMARY OF MUNICIPAL PUMPAGE FOR THE FRESNO AREA, CALIFORNIA, 1931-80,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W88-03393

SOUTHERN CALIFORNIA ALLUVIAL BASINS REGIONAL AQUIFER-SYSTEMS ANALYSIS: A BIBLIOGRAPHY,
Geological Survey, San Diego, CA. Water Resources Div.
For primary bibliographic entry see Field 10C.
W88-03395

INDEX OF HYDROLOGIC DATA FOR SELECTED SITES IN PALM BEACH COUNTY, FLORIDA, 1928-80,
Geological Survey, Miami, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03396

OBSERVATION-WELL NETWORK IN ILLINOIS, 1984,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03397

APPLICATION OF SEISMIC REFRACTION TECHNIQUES TO HYDROLOGIC STUDIES,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03399

HYDROLOGIC-TEST DATA FROM WELLS AT HYDROLOGIC-TEST PADS H-7, H-8, H-9, AND H-10 NEAR THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, SOUTHEASTERN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
S. F. Richey.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-413, 1986. 126 p, 1 fig, 33 tab, 3 ref.

Descriptors: *Radioactive waste disposal, *Hydrologic data, *New Mexico, Groundwater level, Data acquisition, Water depth, Well data, Wells, Eddy County, Waste Isolation Pilot Plant Site.

Hydrologic testing was conducted in 1980 and 1981 at wells at hydrologic test pads H-7, H-8, H-9, and H-10 near the proposed Waste Isolation Pilot Plant site in southeastern New Mexico. Tests were conducted in three zones above the horizon of the proposed underground storage facility. The zones are the Magenta Dolomite Member of the Rustler Formation, the Culebra Dolomite Member of the Rustler Formation, and the Rustler Formation-Salado Formation contact zone. Data presented are from bailing tests, density profiles, shut-in tests, slug tests, flow tests, pressure-pulse tests, and pumping tests. (USGS)
W88-03400

APPROXIMATE ALTITUDE OF WATER LEVELS IN WELLS IN THE CHICOT AND EVANGELINE AQUIFERS IN THE HOUSTON AREA, TEXAS,
Geological Survey, Houston, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03402

GROUND-WATER DATA FOR MICHIGAN--1985,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03403

APPROXIMATE WATER-LEVEL CHANGES IN THE CHICOT AND EVANGELINE AQUIFERS, 1977-86, AND 1985-86 AND MEASURED COMPACTION, 1973-86, IN HARRIS AND GALVESTON COUNTIES, TEXAS,
Geological Survey, Houston, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03404

GROUND-WATER DATA FOR GEORGIA, 1985,
Geological Survey, Doraville, GA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03405

HYDROGEOLOGIC DATA FROM A TEST WELL NEAR PONTE VEDRA, NORTHEAST ST. JOHNS COUNTY, FLORIDA,
Geological Survey, Jacksonville, FL. Water Resources Div.
D. P. Brown, J. A. Miller, and E. C. Hayes.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-410, 1986. 31 p, 19 fig, 1 tab, 5 ref.

Descriptors: *Aquifers, *Monitor wells, *Water quality, *Test drilling, *Water levels, Florida, Water resources data, Artesian flow, Geophysical logging, Floridan aquifer system.

The U.S. Geological Survey and the St. Johns River Water Management District are investigating the hydrogeology of the Floridan aquifer system. An essential element of this investigation is the design and construction of a monitor well network in the lower saline water-bearing zone which occurs at about 2,000 ft below land surface. During 1985, a well near Ponte Vedra in northeast St. Johns County was completed into the lower saline water-bearing zone at a depth of 1,980 to 2,035 ft below land surface. This well and other wells drilled under this or other programs will be used to monitor water levels and water chemistry of the lower saline zone. Chloride concentrations in water above the lower saline zone ranged from 14 to 270 mg/L and specific conductance ranged from 450 to 1,440 micromhos/cm c. In the lower zone, chloride concentrations were as much as 16,210 mg/L and specific conductance as much as 46,000 micromhos per centimeter. Aquifer head and artesian flow from the well generally increased with depth. Water temperatures also increased from 23 C in the upper part of the aquifer to more than 28 C in the lower saline zone. (USGS)
W88-03406

PRELIMINARY DELINEATION AND DESCRIPTION OF THE REGIONAL AQUIFER SYSTEMS OF TENNESSEE--BASAL SANDSTONE AQUIFER WEST OF THE VALLEY AND RIDGE PROVINCE,
Geological Survey, Nashville, TN. Water Resources Div.
J. V. Brahana, M. W. Bradley, J. A. Macy, and D. Mulderink.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 82-762, 1986. 21 p, 11 fig, 3 tab, 13 ref.

Descriptors: *Aquifer systems, *Geohydrology, *Groundwater, *Water quality, *Tennessee, Geohydrologic units, Aquifer characteristics.

The basal sandstone aquifer is believed to underlie most of Tennessee west of the Valley and Ridge Province. It is a Cambrian sandstone that overlies the granites of the Precambrian basement complex. The basal sandstone is a poorly known resource defined only by 14 data points (wells) for the entire state of Tennessee. Because the aquifer occurs at depths of more than 5,500 feet below land surface, and is overlain by about 1,000 feet of low permeability Paleozoic carbonates and shales. Consequently vertical recharge to the aquifer is probably very small per unit area. Data from two sampling sites indicate that the basal sandstone aquifer has low porosity and permeability. The concentrations of dissolved solids in water from the basal sandstone aquifer range from less than 10,000 mg/L to more than 200,000 mg/L. It is believed that some of the values above 50,000 mg/L are due to contaminants from nearby disposal wells. This aquifer is not being used as a source of drinking water because of its great depth, the presence of shallower sources, suspected low yields, and possible concentrations of more than 10,000 mg/L dissolved solids. (USGS)
W88-03407

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN CENTRAL SUMTER COUNTY, FLORIDA, SEPTEMBER 1986,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03408

GROUND-WATER LEVELS IN WATER YEARS 1984-86 AND ESTIMATED GROUNDWATER PUMPAGE IN WATER YEARS 1984-85, CARSON VALLEY, DOUGLAS COUNTY, NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.
D. L. Berger.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-539, 1987. 16 p, 2 fig, 2 tab, 2 ref.

Descriptors: *Hydrologic data, *Groundwater levels, *Groundwater availability, *Pumpage, *Nevada, Surface-groundwater relationships, Withdrawal, Carson Valley, Douglas County, Carson River.

Tabulations of groundwater level measurements made during the water years 1984-86 and summaries of estimated pumpage for water years 1984 and 1985 in Carson valley, Douglas County, Nevada, are included in this report. The data are being collected to provide a record of long-term groundwater changes and pumpage estimates that can be incorporated in a groundwater model change at a later date. (USGS)
W88-03409

RECORDS OF WELLS AND WATER-LEVEL FLUCTUATIONS FROM THE STATEWIDE OBSERVATION-WELL NETWORK IN MONTANA THROUGH 1985,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03411

LAND SUBSIDENCE IN THE SANTA CLARA VALLEY, CALIFORNIA, AS OF 1980,
Geological Survey, Sacramento, CA. Water Resources Div.
J. F. Poland, and R. L. Ireland.
Available from USGS, OFSS, Box 25425, Denver,

CO 80225. USGS Open-File Report 84-818, 1985. 93 p, 48 fig, 6 tab, 39 ref.

Descriptors: *Subsidence, *Compaction, *Aquifer systems, *Artesian head, *California, *Santa Clara Valley, Aquifers, Aquitards, Compressibility, Floods, San Jose.

From 1916 to 1966 in the San Jose area of Santa Clara Valley, California, deficient rainfall and runoff was accompanied by a fourfold increase in groundwater withdrawals. In response the artesian head declined 180-240 ft. The land surface subsided 12.7 ft in San Jose, due to compaction of the fine-grained compressible beds. The subsidence resulted in flooding of lands, and the compaction of the sediments caused compressional failure of many well casings. From 1967 to 1975, the artesian head recovered 70 to 100 feet due to a fivefold increase in surface water imports, favorable local water supply, decreased withdrawal, and increased recharge. In 1960, the Geological Survey installed extensometers in core holes 1,000 ft deep in San Jose and Sunnyvale. Measurements of compaction of the confined aquifer system obtained from these extensometers demonstrate the marked decrease in rate of compaction in response to the major head recovery since 1967. In San Jose the rate decreased from about 1 ft/yr in 1961 to 0.1 ft/yr in 1973. The subsidence has been stopped by raising the artesian head in the aquifers until it equaled or exceeded the maximum pore pressures in the fine-grained beds. However, the subsidence will recommence if the artesian head is drawn down appreciably below the levels of 1971-73. (USGS)
W88-03412

SELECTED HYDROLOGIC DATA FROM A WASTEWATER SPRAY DISPOSAL SITE ON HILTON HEAD ISLAND, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03414

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN CENTRAL SUMTER COUNTY, FLORIDA, MAY 1984,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03415

LINEAR FEATURES DETERMINED FROM LANDSAT IMAGERY IN THE TEXAS AND OKLAHOMA PANHANDLES,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03417

LINEAR FEATURES DETERMINED FROM LANDSAT IMAGERY IN WESTERN KANSAS,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03418

WATER RESOURCES OF HUGHES COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
L. J. Hamilton.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4195, 1986. 60 p, 19 fig, 6 tab, 28 ref.

Descriptors: *Groundwater, *Aquifers, *Reservoirs, *Underground storage, *Aquifer characteristics, *South Dakota, Recharge, Water quality, Hughes County.

Three major glacial-drift aquifers consisting of outwash sand and gravel underlie Hughes County, 784 sq mi of plains incised by the outwash-filled valley of the Missouri River in central South Dakota. Glacial-drift aquifers are recharged by more than 9,000 acre-feet of water annually and store about 1 million acre-feet of water beneath 250 sq mi. Well yields may be as much as 1,000 gal/min. Three major bedrock aquifers of sandstone, shale and limestone store about 100 million acre-feet of geothermal water (22 C to 49 C) beneath the county and yield as much as 1,600 gal/min to flowing wells 800 to 2,600 ft deep. Shut-in pressures in flowing wells increase with depth to more than 400 lbs/sq in. The deepest bedrock aquifer, recharged from the Black Hills of western South Dakota, recharges overlying bedrock aquifers by vertical leakage of 180,000 acre-feet/yr. Dissolved solids concentrations average about 2,000 mg/L in water from both glacial-drift and bedrock aquifers. Average hardness of the water varies from 200 mg/L for the uppermost bedrock aquifer to 900 mg/L for glacial aquifers and 1,400 mg/L for other bedrock aquifers. (USGS)
W88-03420

ALTITUDE AND CONFIGURATION OF THE WATER TABLE, AND DEPTH TO WATER NEAR CHEYENNE, WYOMING, MAY 1984,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. A. Crist.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4154, 1985. 1 sheet (map), 2 fig, 2 ref.

Descriptors: *Water table, *Groundwater movement, *Maps, *Wyoming, Water level, Hydrologic data, Francis E. Warren Air Force Base, Cheyenne.

Altitude and configuration of the water table and depth to water were determined for an area near the southwestern corner of Francis E. Warren Air Force Base which is adjacent to the city limits of Cheyenne, Wyoming. Water levels in the Ogallala Formation, of late Miocene age, generally are less than 20 ft below land surface in this area where there are many private residences on small-acreage lots. Landowners rely on their own wells for water supply and have installed their own septic systems. (USGS)
W88-03421

DELINEATION AND DESCRIPTION OF THE REGIONAL AQUIFER SYSTEMS OF TENNESSEE--THE CUMBERLAND PLATEAU AQUIFER SYSTEM,
Geological Survey, Nashville, TN. Water Resources Div.
J. V. Brahana, J. A. Macy, D. Mulderink, and D. Zemo.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 82-338, 1986. 24 p, 11 fig, 3 tab, 31 ref.

Descriptors: *Aquifer systems, *Geohydrology, *Groundwater, *Water quality, *Tennessee, Geohydrologic units, Aquifer characteristics, Cumberland Plateau.

The Cumberland Plateau aquifer system in Tennessee is composed of the Pennsylvanian sandstones, conglomerates, shales, and coals which underlie the Cumberland Plateau in Tennessee. Major water-bearing zones occur within the sandstones and conglomerates in interconnected fractures. The water-bearing formations are separated by shale and siltstone which retard the vertical circulation of groundwater. The Pennington Formation serves as the base of the aquifer system and is an effective confining layer. The aquifer system is an important water source for the Cumberland Plateau. Wells and springs from the aquifer supply almost all the rural domestic and most of the public supplies of drinking water. Groundwater from wells drilled into the Cumberland Plateau aquifer system is generally of good to excellent quality. Of the 32 water quality analyses, only 2 had dissolved solids concentrations greater than 500 mg/L, and about three-fourths had less than 200 mg/L dissolved solids. However, no samples from deeper than 300 ft have been recorded. Groundwater from locations where the sandstones are buried deeply contain dissolved solids concentration greater than 1,000 mg/L. (USGS)
W88-03424

SOURCE OF SEAWATER INTRUSION AT TAHOLAH AND ADJACENT GROUND-WATER CONDITIONS, QUINAULT INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03425

DELINEATION AND DESCRIPTION OF THE REGIONAL AQUIFER SYSTEMS OF TENNESSEE--THE KNOX AQUIFER,
Geological Survey, Nashville, TN. Water Resources Div.
J. V. Brahana, and M. W. Bradley.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 83-4012, 1985. 32 p, 15 fig, 3 tab, 28 ref.

Descriptors: *Aquifer systems, *Geohydrology, *Groundwater, *Geohydrologic units, *Tennessee, Water quality, Cambrian and Ordovician limestone.

The Knox aquifer is composed of the Cambrian and Ordovician age carbonate rocks of the Knox Group. This aquifer occurs throughout Tennessee, west of the Valley and Ridge province. The Knox crops out in the Sequatchie Valley and in the Wells Creeks cryptoexplosive structure on the Northwestern Highland Rim. Groundwater in the upper Knox occurs primarily in solution openings. The aquifer may be recharged through fractures and faults in the overlying Ordovician limestones in Middle Tennessee. The underlying Conasauga Shale acts as the lower confining layer. Throughout parts of the Central Basin province, the Knox aquifer is an important source of water for rural domestic supplies. In these areas, groundwater from the Knox generally has less than 1,000 milligrams/L dissolved solids. Away from the Central Basin, the dissolved solids concentrations increases. It may approach brine concentrations under the Cumberland Plateau. (USGS)
W88-03426

DELINEATION AND DESCRIPTION OF THE REGIONAL AQUIFER SYSTEMS OF TENNESSEE--THE EAST TENNESSEE AQUIFER SYSTEM,
Geological Survey, Nashville, TN. Water Resources Div.
J. V. Brahana, J. A. Macy, and D. Mulderink.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 82-4091, 1986. 30 p, 10 fig, 4 tab, 34 ref.

Descriptors: *Aquifer systems, *Geohydrology, *Groundwater, *Water quality, *Tennessee, Geohydrologic units, Aquifer characteristics, Valley and Ridge, Blue Ridge, Tennessee.

The east Tennessee aquifer system occurs in the Valley and Ridge and the Blue Ridge provinces of Tennessee. These areas are underlain by rocks of Precambrian to Pennsylvanian age which have been structurally deformed and faulted during the Appalachian orogeny. Groundwater in the Valley and Ridge occurs primarily in solution openings in carbonate rocks and in fractures in sandstone and shale. Fractures in the crystalline rocks store and transmit most of the groundwater in the Blue Ridge province. The east Tennessee aquifer system is important as a source of rural and municipal drinking water. Within 300 ft of land surface, groundwater generally contains less than 500 milligrams/L dissolved solids. At greater depths, fractures and solution openings are smaller and fewer in number. There are very little data to define groundwater occurrence at depths greater than about 300 ft. Groundwater flow may be restricted and the dissolved solids concentrations in the groundwater may reach thousands or even ten thousands of milligrams/L. (USGS)
W88-03430

POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER SYSTEM IN THE SUWAN-

NEE RIVER WATER MANAGEMENT DISTRICT, FLORIDA, MAY 1985,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. C. Rosenau, and P. E. Meadows.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4184, 1986. 1 sheet (map), 1 fig.

Descriptors: *Potentiometric level, *Groundwater levels, *Aquifers, *Floridan aquifer, *Maps, Hydrology, Florida, Suwannee River.

The potentiometric surface map of the Floridan aquifer system in the Suwannee River Water Management District depicts the level to which water rose in tightly cased wells that tap the Floridan aquifer system in May 1985. The Floridan aquifer is the principal source of freshwater for north Florida. The surface was mapped by determining the altitude of water levels in a network of wells and is represented by contours that connect points of equal water level altitude. The Suwannee River Water Management District consists of about 7,600 sq mi, including all or part of 14 counties in north Florida. (USGS)
W88-03431

DELINEATION AND DESCRIPTION OF THE REGIONAL AQUIFER SYSTEM OF TENNESSEE--THE CRETACEOUS AQUIFER SYSTEM,
Geological Survey, Nashville, TN. Water Resources Div.
J. V. Brahana, D. Mulderink, and M. W. Bradley.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 83-4039, 1986. 20 p, 12 fig, 3 tab, 28 ref.

Descriptors: *Aquifer systems, *Geohydrology, *Groundwater, *Water quality, *Tennessee, Geohydrologic units, Cretaceous age, Sand, Clays.

The Cretaceous aquifer in Tennessee is composed of sand and clay of Cretaceous age. The aquifer occurs in west Tennessee from the Mississippi River east to the Tennessee River. Groundwater in the Cretaceous aquifer is recharged at outcrops and through overlying permeable deposits. The overlying Porter's Creek clay acts as the upper confining layer. (USGS)
W88-03432

DELINEATION AND DESCRIPTION OF THE REGIONAL AQUIFER SYSTEMS OF TENNESSEE--THE HIGHLAND RIM AQUIFER SYSTEM,
Geological Survey, Nashville, TN. Water Resources Div.
J. V. Brahana, and M. W. Bradley.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 82-4054, 1986. 38 p, 16 fig, 4 tab, 47 ref.

Descriptors: *Aquifer systems, *Geohydrology, *Groundwater, *Water quality, *Tennessee, Geohydrologic units, Aquifer characteristics, Highland Rim, Mississippian limestones.

The Highland Rim aquifer system in Tennessee is primarily composed of Mississippian carbonates and occurs west of the Valley and Ridge Province. It crops out in the Highland Rim and the Sequatchie Valley. It has been removed by erosion from the Central Basin. Groundwater in the Highland Rim aquifer system occurs primarily in secondary openings including solution openings, joints, and faults. The Chattanooga Shale is the lower confining layer for the Highland Rim aquifer system. Under the Cumberland plateau, this aquifer system is separated from the overlying Pennsylvanian formations by the Pennington Shale. The Highland Rim aquifer system is an important source of drinking water. It supplies most of the rural, domestic, and many public supplies of drinking water in the Highland Rim. Where there is a dynamic flow system, dissolved solids concentrations are less than 500 mg/L. However, isolated cells may exist where the groundwater has dissolved solids concentrations of more than 1,000 mg/L. (USGS)
W88-03433

DELINEATION AND DESCRIPTION OF THE REGIONAL AQUIFER SYSTEMS OF TENNESSEE--THE TERTIARY AQUIFER SYSTEM,
Geological Survey, Nashville, TN. Water Resources Div.
J. V. Brahana, and D. Mulderink.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 83-4011, 1986. 23 p, 12 fig, 4 tab, 34 ref.

Descriptors: *Aquifer systems, *Geohydrology, *Groundwater, *Water quality, *Tennessee, Geohydrologic units, Quaternary and tertiary age, Sands, Clays.

The Tertiary aquifer system in Tennessee is composed of sands and clays of Quaternary and Tertiary age. The aquifer system occurs in west Tennessee from the Mississippi River east to the outcrop of the Porters Creek Clay. Groundwater in the Tertiary aquifer system is recharged at outcrops and through overlying permeable deposits. The underlying Porters Creek Clay acts as the lower confining layer. The Tertiary aquifer system is the single most prolific source of groundwater in Tennessee. The water quality is excellent with generally less than 500 mg/L dissolved solids. (USGS)
W88-03434

DELINEATION AND DESCRIPTION OF THE REGIONAL AQUIFER SYSTEMS OF TENNESSEE--THE CENTRAL BASIN AQUIFER SYSTEM,
Geological Survey, Nashville, TN. Water Resources Div.
J. V. Brahana, and M. W. Bradley.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 82-4002, 1986. 35 p, 15 fig, 4 tab, 35 ref.

Descriptors: *Aquifer systems, *Geohydrology, *Groundwater, *Water quality, *Tennessee, Geohydrologic units, Aquifer characteristics, Central Basin, Sequatchie Valley, Ordovician limestone.

The central Basin aquifer system in Tennessee is composed of Devonian and Ordovician shale and carbonate. This aquifer occurs west of the Valley and Ridge Province and crops out in the Central Basin and the Sequatchie Valley of Tennessee. Groundwater in the Central Basin aquifer occurs primarily in solution openings and fractures and the flow system is generally limited to 300 ft or less below land surface. However, some fracture and minor faults may allow vertical recharge to the underlying Knox Group which marks the lower boundary of the Central Basin aquifer system. Away from the Central Basin, the upper limit of the Central Basin aquifer system is the Chattanooga Shale, an effective confining layer. The Central Basin aquifer system is an important source of drinking water. It supplies most of the rural domestic and many public supplies of drinking water in the Central Basin and the Sequatchie Valley. Where the aquifer is part of a dynamic flow system, dissolved solids concentrations are less than 500 mg/L. Below the zone of dynamic flow, isolated cells may exist in which the groundwater flow is very limited and dissolved solids concentrations may reach thousands or tens of thousands m/L. (USGS)
W88-03435

POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER SYSTEM IN THE NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT, FLORIDA, MAY 1985,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. C. Rosenau, and P. E. Meadows.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4183, 1986. 1 sheet (map), 1 fig.

Descriptors: *Potentiometric level, *Groundwater levels, *Aquifers, *Floridan aquifer, *Maps, Hydrology, Florida.

The potentiometric surface map of the Floridan aquifer system in the northwest Florida Water Management District depicts the level to which water rose in tightly cased wells that tap the Floridan aquifer system in May 1985. The surface was mapped by determining the altitude of water levels in a network of wells and is represented on maps by contours that connect points of equal altitude. The northwest Florida Water Management District consists of about 12,000 sq mi, including all or part of 16 counties in northwest Florida. The Florida aquifer system is the principal source of freshwater for north Florida. (USGS)
W88-03436

CONCEPTS AND DATA-COLLECTION TECHNIQUES USED IN A STUDY OF THE UNSATURATED ZONE AT A LOW-FIELD RADIOACTIVE-WASTE DISPOSAL SITE NEAR SHEFFIELD, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03437

VARIABILITY IN BASE STREAMFLOW AND WATER QUALITY OF STREAMS AND SPRINGS IN OTTER AND ROSEBUD CREEK BASINS, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03440

RECONNAISSANCE OF THE WATER RESOURCES OF THE HOH INDIAN RESERVATION AND THE HOH RIVER BASIN, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03441

WATER RESOURCES OF WESTON COUNTY, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. E. Lowry, W. J. Head, J. G. Rankl, and J. F. Busby.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4079, 1986. 33 p, 8 fig, 2 tab, 26 ref.

Descriptors: *Groundwater, *Aquifers, *Geohydrologic units, *Water supply, *Water resources data, *Wyoming, Water quality, Streamflow, Flow characteristics, Weston County, Black Hills, Powder River basin.

Surface water is scarce in Weston County, Wyoming. Groundwater has been developed from rocks ranging in age from Mississippian to Holocene. Adequate supplies for domestic or stock use can be developed from wells generally less than 1,000 ft deep, except in the area underlain by a thick sequence of predominantly marine shale that will yield only small quantities of very mineralized water. In the early 1960's decreases in artesian pressures occurred in some wells completed in the Lakota Formation of Early Cretaceous age and Pahasapa Limestone of Early Mississippian age. Only the decrease in the Lakota was attributed to development of water from the formation. Extensive development of either of these aquifers, however, may result in significant interference between nearby wells completed within the same aquifer. There are other aquifers within a few hundred feet of the overlying Lakota Formation that could be developed as an alternative to the Lakota to help limit the loss of pressure. The much deeper Pahasapa Limestone generally is developed because of the large supplies that are possible. Because there are no other large yield aquifers, there are no alternatives to limit the loss of pressure of the Pahasapa in the event of increased development. (USGS)
W88-03442

EFFECTS OF SANITARY SEWERS ON GROUND-WATER LEVELS AND STREAMS,

NASSAU AND SUFFOLK COUNTIES, NEW YORK. PART 3--DEVELOPMENT AND APPLICATION OF SOUTHERN NASSAU COUNTY MODEL,
Geological Survey, Syosset, NY. Water Resources Div.
T. F. Reilly, and H. T. Buxton.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 83-4210, 1985. 41 p, 19 fig, 4 tab, 30 ref.

Descriptors: *Groundwater movement, *Sewers, *New York, *Model studies, Groundwater, Surface-groundwater relationships, Groundwater availability, Septic systems, Long Island, Groundwater modeling, Water use, Base flow.

By 1990, sanitary sewers in Nassau County Sewage Disposal Districts 2 and 3 and Suffolk County Southwest Sewer District will discharge to the ocean 140 cu ft of water per second that would otherwise be returned to the groundwater system through septic tanks and similar systems. To evaluate the effects of this loss on groundwater levels and streamflow, the U.S. Geological Survey developed a groundwater flow model that couples a fine-scale subregional model to a regional model of a larger scale. The regional model generates flux boundary conditions for the subregional model, and the subregional model provides detail in the area of concern. Results indicate that the water table will decline by as much as 90% from conditions in the early 1970's. This report is one of a three-part series describing the predicted hydrologic effects of sewers in southern Nassau and southwestern Suffolk Counties. (USGS)
W88-03450

GROUND-WATER FLOW IN THE PRAIRIE DU CHIEN-JORDAN AQUIFER RELATED TO CONTAMINATION BY COAL-TAR DERIVATIVES, ST. LOUIS PARK, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03455

HYDROGEOLOGIC AND WATER-QUALITY CHARACTERISTICS OF THE ST. PETER AQUIFER, SOUTHEASTERN MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03456

SEISMIC REFRACTION STUDY OF SUSPECTED DRIFT-FILLED BEDROCK VALLEYS IN RAMSEY COUNTY, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
D. G. Woodward.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4107, 1985. 20 p, 12 fig, 10 ref.

Descriptors: *Geophysics, *Seismic studies, *Subsurface mapping, *Minnesota, Aquifers, Groundwater contamination, Geohydrology, Ramsey County.

Seismic-refraction surveys were made across suspected buried drift-filled bedrock valleys believed to occur near two sites of known groundwater contamination--the Twin Cities Army Ammunition Plant (TCAAP) near New Brighton and the former Koppers Coke Plant, in St. Paul, Ramsey County, Minnesota. Refraction data were collected along two lines at each site; each line traversed the axis of a suspect valley. Drift-filled bedrock valleys were though to incise the Prairie du Chien-Jordan aquifer to an altitude between 500 and 560 ft above sea level at the TCAAP site. The interpretation of one seismic profile indicates that a valley probably does not exist under the area surveyed; the modeled depth profile shows the bedrock surface ranging between altitudes of about 700 to 780 ft. Interpretation of a second seismic profile just south of the TCAAP indicates that a shallow valley may exist under the northern half of the line; the modeled depth profile shows that the bedrock surface declines from an altitude of about 780 ft to about 690 ft over a horizontal distance of 400 ft. (USGS)
W88-03457

GEOHYDROLOGY OF ROCKS PENETRATED BY THE TEST WELL USW H-4, YUCCA MOUNTAIN, NYE COUNTY, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
M. S. Whitfield, E. P. Eshom, W. Thordarson, and D. H. Schaefer.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4030, 1985. 33 p, 10 fig, 8 tab, 24 ref.

Descriptors: *Aquifer tests, *Hydraulic conductivity, *Transmissivity, *Geophysical logging, *Chemical analysis, *Nevada, *Radioactive waste storage, Crater Flat Tuff, Lithic Ridge Tuff, Yucca Mountain, Nevada Test Site, Nye County.

Test well USW H-4 is one of several wells drilled in the southwestern part of the Nevada Test Site for hydraulic testing, hydrologic monitoring, and geophysical logging. The work was performed in cooperation with the U.S. Department of Energy. The rocks penetrated by the well to a total depth of 1,219 m were volcanic tuffs of Tertiary age. Hydraulic coefficients calculated from pumping test data indicate that transmissivity ranged from 200 to 790 sq m/day. A radioactive tracer, borehole flow survey indicated that the two most productive zones during this borehole flow survey occurred in the upper part of the Bullfrog Member of the Crater Flat Tuff, depth interval from 721 to 731.5m, and in the underlying part of the Tram Member, depth interval from 864 to 920m. The water is predominantly a sodium biocarbonate type with small concentrations of calcium, magnesium, and sulfate. The apparent age of this composite water sample was determined by carbon-14 date of 17,200 years before present. (USGS)
W88-03458

DESCRIPTION OF AQUIFER UNITS IN EASTERN OREGON,
Geological Survey, Portland, OR. Water Resources Div.
J. B. Gonthier.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4095, 1985. 39 p, 13 fig, 7 tab, 110 ref.

Descriptors: *Aquifers, *Geology, *Groundwater, *Underground waste disposal, *Oregon, Flow systems, Path of pollutants, Geohydrology.

Geologic formations in Oregon, east of the crest of the Cascade Range, have been grouped according to similarities in their hydrogeologic and geologic properties into six major aquifer units. Two of the units, the Mesozoic-Paleozoic and the John Day-Clarno aquifers, are low-permeability aquifers, have hydraulic conductivities generally less than 1 ft/d (feet per day), and are generally capable of yielding only a few gallons per minute to wells. These are important aquifer units, nevertheless, because they are the only economical source of domestic water present in east-central Oregon where they outcrop. Four of the aquifer units contain beds or zones of high permeability materials with hydraulic conductivities that commonly range between 5 and 50 ft/d. In many localities where these units are present, they are capable of yielding 200 gallons/min or more to wells. These productive aquifer units are the Columbia River Basalt, the Cenozoic volcanic and sedimentary, Cenozoic sedimentary, and the Quaternary sediment aquifers, respectively. North of the Blue Mountains, the Columbia River Basalt aquifer is a major aquifer of regional extent and, in that area, heavy withdrawals, chiefly for irrigation, have resulted in regional groundwater level declines. South of the Blue Mountains, the basalt underlies rugged terrane, is not developed, and little is known about its hydraulic properties. Other major aquifer units are heavily developed in localized areas or in basins throughout eastern Oregon. (USGS)
W88-03459

GEOCHEMICAL CONTROLS ON DISSOLVED SODIUM IN BASALT AQUIFERS OF THE COLUMBIA PLATEAU, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W88-03460

EVALUATION OF THE CENTRAL BASIN AQUIFER SYSTEM IN TENNESSEE FOR RECEIVING INJECTED WASTES,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 5E.
W88-03461

DOCUMENTATION OF A NUMERICAL CODE FOR THE SIMULATION OF VARIABLE DENSITY GROUND-WATER FLOW IN THREE DIMENSIONS,
Geological Survey, Austin, TX. Water Resources Div.
L. K. Kuiper.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4302, 1985. 24 p, 2 fig, 8 ref, 5 append.

Descriptors: *Mathematical models, *Groundwater, *Confined aquifer, *Numerical analysis, *Finite difference analysis, Simulation, Saline water, Variable density, Preconditioned conjugate gradient, Conjugate gradient.

A numerical code is documented for the simulation of variable density time dependent groundwater flow in three dimensions. The groundwater density, although variable with distance, is assumed to be constant in time. The Integrated Finite Difference grid elements in the code follow the geologic strata in the modeled area. If appropriate, the determination of hydraulic head in confining beds can be deleted to decrease computation time. The strongly implicit procedure (SIP), successive overrelaxation (SOR), and eight different preconditioned conjugate gradient (PCG) methods are used to solve the approximating equations. The use of the computer program that performs the calculations in the numerical code is emphasized. Detailed instructions are given for using the computer program, including input data formats. An example simulation and the Fortran listing of the program are included. (USGS)
W88-03464

DETERMINATION OF DIFFUSIVITIES IN THE RUSTLER FORMATION FROM EXPLORATORY SHAFT CONSTRUCTION AT THE WASTE ISOLATION PILOT PLANT SITE, SOUTHEASTERN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
K. Stevens, and W. Beyeler.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4020, 1985. 32 p, 13 fig, 4 tab, 24 ref.

Descriptors: *Aquifer testing, *Radioactive waste disposal, *Diffusivity, *New Mexico, Groundwater, Geohydrology, Path of pollutants, Eddy County, Waste Isolation Pilot Plant site.

The construction of an exploratory shaft 12 feet in diameter into the Salado Formation (repository horizon for transuranic waste material) at the Waste Isolation Pilot Plant site in southeastern New Mexico affected water-levels in water-bearing zones above the repository horizon. By reading the construction history of the exploratory shaft, an approximation of construction-generated hydraulic stresses at the shaft was made. The magnitude of the construction-generated stresses was calibrated using the hydrographs from one hydrologic test pad. Whereas flow rates from the Magenta Dolomite and Culebra Dolomite Members in the Rustler Formation into the exploratory shaft were unknown, the ratio of transmissivity to storage (diffusivity) was determined by mathematically simulating the aquifers and the hydrologic stresses with flood-wave-response digital model. These re-

sults indicate that the Magenta Dolomite and Culebra Dolomite Members of the Rustler Formation can be modeled as homogeneous, isotropic, and confined water-bearing zones. One simple and consistent explanation, but by no means the only explanation, of the lack of a single diffusivity value in the Culebra aquifer is that the open-hole observation wells at the hydrologic test pads dampen the amplitude of water-level changes. (USGS)
W88-03466

AQUIFER TESTS AT THE JACKPILE-PAGUATE URANIUM MINE, PUEBLO OF LAGUNA, WEST-CENTRAL NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
D. W. Risser, P. A. Davis, J. A. Baldwin, and D. P. McAda.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4255, 1984. 26 p, 12 fig, 16 ref.

Descriptors: *Aquifers, *Transmissivity, *New Mexico, *Uranium mines, *Mine reclamation, *Geohydrology, Aquifer tests, Water levels, Groundwater data.

The transmissivity of the Jackpile sandstone bed in the Brushy Basin Shale Member of the Morrison Formation, west-central New Mexico, was determined to be 24 sq ft/day at well M2 and 47 sq ft/day at well M3 from constant-discharge aquifer tests conducted at the Jackpile-Paguate Uranium Mine. The storage coefficient of the Jackpile sandstone bed was estimated to be 0.00018 at well M2 and 0.00029 at well M3 from the same tests. An aquifer test conducted at well M21 indicated the transmissivity of the Jackpile sandstone bed was 2.0 sq ft/day and the storage coefficient was 0.00002. The transmissivity of an unnamed sandstone bed in the Brushy Basin Shale Member of the Morrison Formation was estimated from 'slug-test' results to be about 20 sq ft/day. Water levels in this sandstone probably did not change due to pumping from the overlying Jackpile sandstone bed for 88 hours at an average discharge of 15.3 gallons/min. A constant discharge aquifer test at well M4C indicated that the transmissivity of the alluvium at this location was about 430 sq ft/day. Water levels in the underlying Jackpile sandstone bed began declining within 15 minutes after withdrawals of groundwater from the alluvial aquifer began. (USGS)
W88-03468

APPLICATION OF A LAYERED GROUNDWATER MODEL TO CRITICAL AREAS IN NORTHEAST MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
V. L. Zitta, and T.-H. Pang.
Available from the National Technical Information Service, Springfield, VA 22161, as PB87-159430/AS. Price codes: A05 in paper copy, A01 in microfiche. Mississippi Water Resources Research Institute, Mississippi State. Technical Completion Report G1026-02. July 1986. 71 p, 9 fig, 3 tab, 34 ref, 3 append. Contract No. 14-08-0001-G1026. Project No. USGS G1026-02.

Descriptors: *Groundwater, *Mississippi, *Model studies, Modeling, Management, Groundwater movement, Drawdown, Water levels, Mathematical models.

A layered groundwater model developed by McDonald and Harbaugh was applied to the Eutaw-Mcshan aquifer in Northeast Mississippi using a 2.5 mi sq grid. The need for a more precise model resulted from a previous study using a large grid (10 sq mi grid) and estimated parameters. Initial estimates of the aquifer geometry were obtained from maps developed by the U.S. Geological Survey. This information was supplemented by electric logs of wells which were used to either refine or verify aquifer geometry. Historical pumping records were obtained from municipalities and industries in the critical areas of West Point, Tupelo, and Aberdeen which records were analyzed to refine the pumping data input. Model parameters were calibrated using a 1978 and a 1982 potentiometric map of the aquifer prepared by the U.S. Geological Survey. Values of hydraulic conductivity and storage coefficient were adjusted systematically until the measured and computed potentiometric surfaces were within reasonable agreement. A geometric contouring program, Surface II, was used to construct potentiometric contours from a computed matrix. Based upon this information, the aquifer parameters were calibrated to reproduce the potentiometric heads in the aquifer from 1978 to 1982. (Zitta-Mississippi State Univ.)
W88-03483

ASSESSMENT AND COMPILATION OF GROUND-WATER QUALITY DATA FOR MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7C.
W88-03485

ANALYSES OF GROUNDWATER FOR TRACE LEVELS OF PESTICIDES,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
For primary bibliographic entry see Field 5A.
W88-03489

2G. Water In Soils

ELEMENT LEACHING AND CAPILLARY RISE IN SANDY SOIL CORES: EXPERIMENTAL RESULTS,
Atomic Energy of Canada Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.
M. I. Sheppard, D. H. Thibault, and J. H. Mitchell.
Journal of Environmental Quality JEVQAA, Vol. 16, No. 3, p 273-284, July-September 1987. 13 fig, 6 tab, 21 ref.

Descriptors: *Soil water, *Path of pollutants, *Waste disposal, *Leaching, *Hazardous wastes, *Underground waste disposal, *Groundwater pollution, *Unsaturated zone, Capillary rise, Groundwater, Rainfall.

Disposal of hazardous wastes by burial is a common practice. This practice usually involves several barriers to the migration of the wastes, one of which is the unsaturated soil zone. The long-term consequences of capillary rise of water and its dissolved contaminants through the unsaturated soil is not easy to assess. Similarity, downward migration after a surface contamination event, such as irrigation with contaminated groundwater, is a complex process. This study examines both the leaching and capillary rise of Tc, I, Np, U, Th, Cs, Cr, and Mo through a sandy soil. Eighty undisturbed soil cores from a forest floor were contaminated, half were contaminated 10 cm from their base to simulate contact with contaminated groundwater (groundwater cores), and the other half were contaminated below the litter layer to simulate soil surface deposition (leaching cores). Cups at the base of the cores served as receptacles for groundwater or for leachate. The cores were placed in the ground with their surface exposed to natural rainfall. After 1 yr, half of the cores were exhumed. Soil moisture and temperature conditions in the cores reflected the trends of moisture and temperature at the coring site. Leachate analyses and exhumation data of the leaching cores indicated element mobility as Tc > or = I >> Mo > or = Cr >>> U > or = Np, Cs, Th, with Tc the most mobile and Th the least mobile. Only Tc, I, Mo, and Cr passed through the cores in the leachate in the first year. The groundwater cores showed that T, I, Mo, and Cr are most likely to reach surface soils from contaminated groundwater based on one year of data. Partition coefficient (K sub d) values for Tc, I, and U from batch sorption experiments were compared with D sub d values obtained from the exhumation porewater and soil, by soil horizon. (Author's abstract)
W88-02722

CASE STUDY TO ASSESS THE POTENTIAL FOR SALINE SOIL DEVELOPMENT DUE TO IRRIGATION,
Alberta Univ., Edmonton. Dept. of Geology.
F. W. Schwartz, A. S. Crowe, M. J. Hendry, and D. W. Chorley.
Journal of Hydrology JHYDA7, Vol. 91, No. 1/2, p 1-27, May 15, 1987. 16 fig, 2 tab, 38 ref.

Descriptors: *Saline soils, *Irrigation effects, *Environmental effects, *Model studies, *Data interpretation, Soil contamination, Soil environment, Soil management, Soil profiles, Soil properties, Irrigation, Flow pattern, Flow models, Alberta, Canada, Groundwater, Geology, Geohydrology.

With the help of a generalized conceptual model for the formation of saline soil, the problem of whether irrigation proposed for an area near Lethbridge, Alberta will compound an existing salinity problem was examined. The geology of the site is characterized by weathered and non-weathered tills which overlie Cretaceous bedrock. Locally, preglacial sands and gravels occur along the axes of two bedrock valleys beneath the site. Piezometric data define local groundwater flow from west to east, following the regional topographic slope. However, the depth to the water table is extremely variable and controlled by the preglacial sand and gravel unit. The existing problem of soil salinity, which is restricted to the western part of the study area, is caused by the high water table and large quantities of dissolved mineral mass in the groundwater. In the central and eastern part of the area, the water table occurs at depths greater than 20 m and saline soils did not form. Flow modeling along a two-dimensional cross section confirms that the water table configuration and hence the distribution of saline soils is controlled by the preglacial deposits. Indications are that excess recharge due to irrigation will not result in a water table rise unless the quantity involved is considerably larger than the natural rate of recharge. Thus, irrigation will not contribute to a marked increase in the size of the area affected by the saline soil. (Author's abstract)
W88-02764

FIELD TEST OF A SIMPLE SOIL-WATER BALANCE MODEL FOR IRRIGATED AREAS,
Indian Agricultural Research Inst., New Delhi. Water Technology Center.
N. H. Rao.
Journal of Hydrology JHYDA7, Vol. 91, No. 1/2, p 179-186, May 15, 1987. 4 fig, 13 ref.

Descriptors: *Soil water, *Soil water balance, *Model testing, *Data interpretation, *Irrigation design, *Model studies, *Irrigation, Field tests, Evapotranspiration, Soil moisture retention, Soil-water-plant relationships, Computer models, Mathematical equations, Irrigation programs, India.

A simple conceptual model of soil water balance is proposed and tested with field data obtained from a case study area in the Nagarjunasagar Irrigation Project Area, Andhra Pradesh, India. The model estimates the actual evapotranspiration and the soil moisture content at the end of each week using available information on soil water availability and plant water uptake. It can be usefully incorporated into larger computer-based irrigation management models. On a small scale, the lumping of several discrete inputs of water represented by rainfall from several storm events and irrigations during the week, and its instantaneous uniform redistribution over the effective root zone is a limiting assumption. However, in the larger context of irrigation management, the scale of both the size of the area affected and the convenient time intervals for operating irrigation systems provide justification for the model simplifications. (Wood-PTT)
W88-02774

ESTIMATION OF BROOKS-COREY PARAMETERS FROM WATER RETENTION DATA,
Princeton Univ., NJ. Water Resources Program.
P. C. D. Milly.
Water Resources Research WRERAQ, Vol. 23, No. 6, p 1085-1089, June 1987. 5 fig, 12 ref.

Descriptors: *Soil water, *Brooks-Corey parameters, *Water retention, *Estimating, *Data inter-

pretation, Mathematical studies, Mathematical equations, Least squares method, Integral objective function, Model studies.

The parameters of the Brooks-Corey soil moisture characteristics may be determined by either graphical or automatic numerical procedures. A popular log-log procedure for automatic estimation leads to a linear least squares optimization problem. Apparently, it has been applied incorrectly in the past when all measurements were used for parameter estimation, and this realization explains the inconsistencies in some published data. Its proper application generally requires the solution of more than one linear problem for each data set. Alternatively, a nonlinear procedure will yield parameter estimates directly. In either case there may exist multiple local minima in the sum of squared deviations between model and measurements, and the parameter estimates so derived are demonstrably unreliable; this appears to be a result of the distinct air-entry suction implicit in the Brooks-Corey model and usually absent in field-measured characteristic curves. A new procedure based on an integral objective function overcomes the problems cited. (Author's abstract)
W88-02786

ADSORPTION OF BUTACHLOR TO SOILS,
Monsanto Agricultural Research Station, Ibaraki (Japan).
For primary bibliographic entry see Field 5B.
W88-02792

METHOD FOR MEASURING ENRICHED LEVELS OF DEUTERIUM IN SOIL WATER,
Cold Regions Research and Engineering Lab., Hanover, NH.
J. L. Oliphant, T. F. Jenkins, and A. R. Tice.
Available from the National Technical Information Service, Springfield, VA 22161, as ADA-123070, A02 in paper copy, A01 in microfiche. Special Report 82-25, November 1982. 12 p, 3 fig, 2 tab, 10 ref. Project No. 4A161101A910.

Descriptors: *Deuterium, *Heavy water, *Isotopes, *Tracers, Isotope studies, Isotopic tracers, Soil water, Soil porosity, Soil solution.

Because the ability to measure hydrogen isotope ratios in water can be useful for studying water movement and properties in the field and laboratory, a method was developed for measuring enriched levels of deuterium in soil water. The specific procedures for analyzing hydrogen isotope ratios are described. Hydrogen is separated from liquid water or soil water by reacting the water with heated uranium. An isotope-ratio mass spectrometer determines the atom percent deuterium in the hydrogen to a precision of 0.0075. Techniques for upgrading the mass spectrometer to obtain better precision are also discussed. (Halterman-PTT)
W88-02891

CHEMICAL EQUILIBRIA TO MODEL VOLATILIZATION OF AMMONIA FROM AQUATIC AND SOIL SYSTEMS,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W88-03170

RISK OF LEAVING THE SOIL SURFACE UNPROTECTED AGAINST FALLING RAIN,
Shahid Chamran Univ., Ahvaz (Iran). Dept. of Soil Science.
For primary bibliographic entry see Field 2J.
W88-03193

SOIL WATER CONSERVATION UNDER ZERO- AND CONVENTIONAL TILLAGE SYSTEMS ON THE CANADIAN PRAIRIES,
Saskatchewan Univ., Saskatoon. Saskatchewan Inst. of Pedology.
For primary bibliographic entry see Field 3F.
W88-03194

ACIDIFICATION OF FOREST SOILS: MODEL DEVELOPMENT AND APPLICATION FOR ANALYZING IMPACTS OF ACIDIC DEPOSITION IN EUROPE,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 5C.
W88-03195

EFFECTS OF LIQUID ORGANIC CONTAMINANTS ON GEOTECHNICAL PROPERTIES OF CLAY SOILS,
New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5C.
W88-03254

SPATIAL VARIABILITY OF INFILTRATION RATES ON A SEMIARID SEEDED RANGELAND,
Utah State Univ., Logan. Coll. of Natural Resources.
M. Merzougui, and G. F. Gifford.
Hydrological Sciences Journal HSJODN, Vol. 32, No. 2, p 243-250, June 1987. 3 fig, 2 tab, 15 ref.

Descriptors: *Infiltration rate, *Spatial variability, *Measuring instruments, *Data acquisition, *Semiarid lands, Range grasses, Field tests, Infiltration capacity, Rainfall, Infiltrometers, Rainfall simulators, Grasslands, Utah.

Field studies determined the spatial variability patterns of field-measured infiltration rates on semiarid seeded rangeland near Eureka, Utah. Two kinds of instruments, namely a double-ring infiltrometer and a modular type rainfall simulator, were used in both a moderately grazed pasture and an ungrazed enclosure (protected for over 20 years) to measure infiltration rates at 10 and 30 minutes. There were 104 grid points per instrument on a 24 m x 24 m grid (2 m spacing) at each site, with a total of 416 infiltrometer plots. Dependency of specific infiltration rate measurements on nearby measurements, as determined from autocorrelograms and semivariograms, was nonexistent. Percent cover (vegetation plus litter) explained from 18 to 36% of the variance associated with measured infiltration rates. (Author's abstract)
W88-03281

2H. Lakes

RESPONSE OF LIMED LAKES TO EPISODIC ACID EVENTS IN SOUTHWESTERN SWEDEN,
Swedish Environmental Research Inst., Goeteborg.
For primary bibliographic entry see Field 5C.
W88-02498

INDICATOR BACTERIA CONCENTRATIONS AS AFFECTED BY HYDROLOGIC VARIABLES IN THE APALACHICOLA RIVER, FLORIDA,
Geological Survey, Tallahassee, FL.
For primary bibliographic entry see Field 5B.
W88-02501

EFFECTS OF RECENT ENVIRONMENTAL CHANGES IN LAKE WAAHI ON TWO FORMS OF THE COMMON SMELT RETROPINNA RETROPINNA, AND OTHER BIOTA,
Manitoba Univ., Winnipeg. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W88-02502

LAKE RESTORATION METHODS: SOME WORK, SOME DONT,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 5G.
W88-02515

WATER QUALITY MANIPULATIONS IN A EUTROPHIC IMPOUNDMENT,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5G.
W88-02524

APPLICATION OF A TWO-DIMENSIONAL MODEL OF HYDRODYNAMICS AND WATER QUALITY (CE-QUAL-W2) TO DEGRAY LAKE, ARKANSAS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
J. L. Martin.
Available from the National Technical Information Service, Springfield, VA. 22161. Technical Report E-87-1, March 1987. Final Report. 79 p, 24 fig, 3 tab, 31 ref, append.

Descriptors: *Mathematical models, *Water quality, *DeGray Lake, *Arkansas, *Model studies, *Reservoirs, *Limnology, *CE-QUAL-W2, Hydrodynamics, Dissolved oxygen, Lakes, Nutrients, Refraction, Iron, Phosphorus, Adsorption, Mathematical studies.

DeGray Lake in Arkansas has been extensively studied by the Corps of Engineers and is known to exhibit seasonal variations in water quality along both longitudinal and vertical axes. A model study, CE-QUAL-W2, served a number of purposes including analysis and refinement of the code, location and correction of errors in the code and data sets, sensitivity analyses, and other tests of the code as well as comparisons of model predictions with data collected. Descriptions of the application and testing include an overview of the basic features of CE-QUAL-W2. Model simulations adequately characterized variations in the water quality in DeGray Lake over the entire stratification cycle. The onset of anoxia was correctly characterized as well as release of iron and nutrients under anoxic conditions. The establishment of a metalimnetic DO minimum was also predicted in the lower regions of the reservoir. The fall deepening of the thermocline was adequately characterized, as were the effects of the introduction of oxygen on anaerobic materials. The importance of sediments in the transition zone to the overall DO and nutrient dynamics was demonstrated. The transition zone, while comprising only approximately 20% of total volume, had a large effect on the predicted DO and nutrient dynamics of the reservoir. Flux computations also indicated that this region was much more dynamic than the lacustrine zone. The model indicated several areas which require additional attention, including means of identifying and quantifying labile and refractory components of dissolved organic matter, the descriptions of iron and phosphorus interactions, and the kinetics of phosphorus adsorption and desorption. The algorithms to predict inorganic carbon, alkalinity, pH, and carbonate species as well as sediments (as a compartment which accumulates and decays organic matter) were not completely tested in this application and also require further attention. (See also W88-02533) (Lantz-PTT)
W88-02559

SUPPLEMENTAL LIMNOLOGICAL STUDIES AT RICHARD B. RUSSELL AND CLARKS HILL LAKES, 1983-1985,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
R. H. Kennedy.
Available from the National Technical Information Service, Springfield, VA. 22161. Miscellaneous Paper E-87-2, April 1987. Final Report. 217 p, 52 fig, 34 tab, 141 ref, 5 append.

Descriptors: *Limnology, *Lakes, *Richard B. Russell Lake, *Clarks Hill Lake, Water quality, Oxygenation, Nutrients, Decomposition, Sediment-water interfaces.

A 3-year, comprehensive water quality study was initiated in 1983 at Richard B. Russell and Clarks Hill Lakes, Georgia-South Carolina. Objectives of the study were to evaluate water quality changes in both lakes following the impoundment of Richard B. Russell Lake and to monitor the perform-

ance of an oxygenation system installed in the forebay of Richard B. Russell Lake. In addition to this study, supplemental studies were conducted to provide more detailed information concerning processes influencing water quality conditions in the two lakes. Results of these studies, which centered on establishment of biological communities, decomposition, nutrient and metal dynamics, sediment/water exchanges, and interactions between the lakes, were presented at a symposium held 5-6 February 1985 at Hickory Knob State Park, McCormick, S.C. This report documents results presented at the symposium. (See also W88-02533) (Author's abstract)
W88-02561

INDUSTRIAL AND COMMERICAL APPLICATIONS: DREDGING FOR LAKE RESTORATION,
Port of Vancouver, WA.
R. F. Gorini.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 179-185.

Descriptors: *Dredging, *Lake restoration, *Aquatic habitats, *Spoil disposal, *Waste disposal, *Sediment disposal, *Environmental impact statement, *Water quality, Lakes, Project planning, Wildlife habitat, *Beneficial use.

The restoration of a natural lake on the Columbia River floodplain by dredging, flushing, contouring and deepening the lake is described. The 4.5-sq mile lake was affected by agricultural and urban runoff. Through funding set up by the Clean Water Act amendments of 1972, water flows into the lake were imporved. A 4,300-ft flushing channel with two 84-inch culverts were built. The lake was deepened and the dredged material was used to build an island, a shoreline and to fill 600 acres with material. The 170-acre dredged material disposal site was used to grow barley and alfalfa. A beach was built to be used by the public. The lake has been used by young salmon for resting. Before the project, the waters in the lake turned over about every 24 yr. After the project was completed the water was replaced in about 21 days. The project was finished 6 months ahead of schedule and $500,000 under budget. (See also W88-02563) (Geiger-PTT)
W88-02576

NATURAL PROPAGATION AND HABITAT IMPROVEMENT - WASHINGTON, VOLUME IIB, SIMILKAMEEN RIVER HABITAT INVENTORY.
Bonneville Power Administration, Portland, OR. Div. of Fish and Wildlife.
For primary bibliographic entry see Field 8I.
W88-02584

CALIBRATION OF THEMATIC MAPPER THERMAL DATA FOR WATER SURFACE TEMPERATURE MAPPING: CASE STUDY ON THE GREAT LAKES,
Wisconsin Univ., Madison. Inst. for Environmental Studies.
For primary bibliographic entry see Field 7B.
W88-02679

SULFATE REDUCTION IN PEAT FROM A NEW JERSEY PINELANDS CEDAR SWAMP,
Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
H. G. Spratt, M. D. Morgan, and R. E. Good.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 7, p 1406-1411, July 1987. 2 fig, 4 tab, 25 ref.

Descriptors: *Sulfur compounds, *Sulfate reduction, *Cedar swamps, *New Jersey Pine Barrens, *Acidic water, *Wetlands, Moss, Pore water, Sulfates, Groundwater, Sulfur, Peat.

Microbial sulfate reduction rates in acidic peat from a New Jersey Pine Barrens cedar swamp in 1986 were similar to sulfate reduction rates in freshwater lake sediment. The rates ranged from a low of 1.0 nmol/cu cm/day in February at 7.5- to 10.0-cm depth to 173.4 nmol/cu cm/day in July at 5.0- to 7.5-cm depth. The presence of living Sphagnum moss at the surface generally resulted in reduced rates of sulfate reduction. Pore water sulfate concentrations and water table height also apparently affected the sulfate reduction rate. Concentrations of sulfate in pore water were nearly always higher than those in surface water and groundwater, ranging from 26 to 522 micron. The elevated pore water sulfate levels did not result from the evapotranspiratory concentration of infiltrating stream water or groundwater, but probably resulted from oxidation of reduced sulfur compounds, hydrolysis of ester sulfates present in the peat, or both. The total sulfur content of peat that had no living moss at the surface was 164.64 + or - 1.5 and 195.8 + or - 21.7 micromol/g(dry weight) for peat collected from 2.5 to 5.0 and 7.5 to 10.0 cm, respectively. Organosulfur compounds accounted for 84 to 88% of the total sulfur that was present in the peat. C-bonded sulfur accounted for 91 to 94% of the organic sulfur, with ester sulfate being only a minor constituent. Reduced inorganic sulfur species in peat from 2.5 to 7.5 cm were dominated by H2S-FeS (68%), while pyritic sulfide was the predominant inorganic sulfur species in the peat from depths of 7.5 to 10.0 cm (75%). (Author's abstract)
W88-02703

SIMULTANEOUS DETERMINATION OF NITRIFICATION AND NITRATE REDUCTION IN SEDIMENT-WATER COLUMNS BY NITRATE-15 DILUTION,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 5B.
W88-02718

SENSITIVE METHODS FOR THE DETERMINATION OF MICROBIAL ACTIVITIES IN WATER SAMPLES USING FLUORIGENIC SUBSTRATES,
ESWE-Inst. fuer Wasserforschung und Wassertechnologie G.m.b.H., Weisbaden (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W88-02723

ACCURACY OF SEDIMENT DEPOSITION ESTIMATION,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W88-02779

RESPONSES OF STREAM ALGAE TO GRAZING MINNOWS AND NUTRIENTS: A FIELD TEST FOR INTERACTIONS,
Oklahoma Univ., Kingston. Biological Station.
A. J. Stewart.
Oecologia OECOBX, Vol. 72, No. 1, p 1-7, April 1987. 3 fig, 5 tab, 30 ref. NSF Support BSR-8307014. USDE Contract DE-AC05-840R21400.

Descriptors: *Fish diets, *Fish foods, *Fertilizers, *Algae, *Algal growth, *Stream algae, *Minnows, *Nutrients, Marine algae, Field tests, Oklahoma, Brier Creek, Grazing.

Previous studies showed that an algivorous grazing minnow (Campostoma anomalum) is the major herbivore in Brier Creek, a hardwater stream in Oklahoma. In summer and autumn schools of Campostoma virtually eliminate algae from substrate surfaces in deeper areas of some pools. The pool-to-pool distributions of algae and Campostoma reported for this stream could occur if nutrient limitation permits grazing by Campostoma to 'outrun' algal growth. To test this hypothesis, mesh pens were built to exclude Campostoma from substrates in each of four typical Campostoma pools. N+P+K lawn fertilizer was added daily to two of the four pools; the other two, which received no fertilizer additions and which were not visibly affected by fertilizer transported downstream from the pools enriched with nutrients, served as controls. Algae accumulated rapidly on natural substrates and on unglazed tiles in grazer-exclusion pens receiving fertilizer additions and more slowly in pens in both control pools. Periphyton biomass on grazed substrates in all four pools remained low throughout the experiment. Hence, Campostoma at normal densities were able to outrun algal growth even when nutrients were added. It was concluded that although nutrient supply limits biomass-specific primary productivity of periphyton in Brier Creek, nutrient limitation in this stream exacerbates, rather than causes, the visually conspicuous pool-to-pool complimentary distribution of algae and Campostoma. (Author's abstract)
W88-02796

MEMBRANE FILTER METHOD FOR THE ENUMERATION OF AQUATIC AMMONIFIERS,
Colorado State Univ., Fort Collins. Dept. of Microbiology and Environmental Health.
For primary bibliographic entry see Field 5B.
W88-02831

EFFECT OF ENVIRONMENTAL FACTORS ON COLIPHAGES IN THE WELSH RIVER DEE,
University Coll., Galway (Ireland). Dept. of Microbioloby.
D. Nuttal, and O. T. Parry.
Letters in Applied Microbiology, Vol. 4, No. 5, p 117-120, May 1987. 1 fig, 2 tab, 16 ref.

Descriptors: *Environmental effects, *River Dee, *Rivers, *Coliphages, Wales, Growth, Bacteria, Seasonal variation, Temperature.

In a 1-year study at Ironbridge on the Welsh River Dee the Escherichia coli population varied over a 200-fold range and the coliphage populations grown at 37 C (H.T. phage) and at 22 C (L.T. phage) each varied by over 100-fold. Both the E. coli and H.T. phage counts were shown to have highly significant seasonal fluctuations, which included troughs in summer and peaks in winter. The L.T. phage count appeared to maintain a baseline population in summer and had a 20-fold less significant association with temperature than the H.T. phage population. (Author's abstract)
W88-02876

TRACE METAL REDUCTION BY PHYTOPLANKTON: THE ROLE OF PLASMALEMMA REDOX ENZYMES,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W88-02878

AQUATIC HYPHOMYCETE SPORA IN 10 STREAMS OF NEW BRUNSWICK AND NOVA SCOTIA,
Mount Allison Univ., Sackville (New Brunswick). Dept. of Biology.
F. Barlocher.
Canadian Journal of Botany CJBOAW, Vol. 65, No. 1, p 76-79, January 1987. 1 fig, 2 tab, 18 ref.

Descriptors: *Hyphomycetes, *Streams, *Fungi, Alkalinity, Metals, Ions, Water chemistry, Population density.

Aquatic hyphomycete communities of 10 soft-water streams in Nova Scotia and New Brunswick were investigated with a foam sampling technique. The number of identifiable species varied between 26 and 42. Alkalinity, conductance, pH, and content of Ca(2+), Mg(2+), Na(+), and K(+) were measured in all streams. No significant correlation was found between number of fungal species and any of the chemical parameters. Combining the data with those of an earlier study revealed a significant, negative correlation between species number of a stream and its pH. The number of aquatic hyphomycetes appears to decline slowly, if at all, between 5 and 7. This is followed by a more rapid loss at values above 7. (Author's abstract)
W88-02879

EFFECTS OF TRACE METALS ON GROWTH OF RED TIDE PHYTOPLANKTON AND THEIR ACCUMULATION OF METAL,
Government Industrial Research Inst., Chugoku, Kure (Japan).
For primary bibliographic entry see Field 2L.
W88-02885

IMPACT OF AUGMENTED FIELD POPULATIONS OF ARZAMA DENSA LARVAE ON WATERHYACINTH,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 4A.
W88-02925

HYDROLOGY OF LAKE CARROLL, HILLSBOROUGH COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
S. E. Henderson, R. D. Hayes, and Y. E. Stoker.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4261, 1984. 1 p, 13 fig, 2 tab, 20 ref.

Descriptors: *Lakes, *Surface-groundwater relationships, *Florida, Limnology, Dredging, Lake stages, Bathymetry, Aquatic plants, Hydrologic budget, Lake Carroll, Hillsborough County, Southwest Florida Water Management District.

Lakeshore property around Lake Carroll has undergone extensive residential development since 1960. This development increased the lake shoreline, altered surface water flow to and from the lake, and may have affected lake-stage characteristics. Some areas of the lake were dredged to provide fill material for lakefront property. Water-balance analyses for 1952-60, a predevelopment period, and 1961-80, a period of residential development, indicate that both net surface water flow to the lake and downward leakage from the lake to the Floridan aquifer were greater after 1960. These changes were due more to changes in the regional climate and related changes in ground-water levels than to changes associated with residential development. Results of water quality analyses in 1980-81 are within State limits for surface waters used for recreation and wildlife propagation. (USGS)
W88-02980

COMPUTATION OF INFLOWS AND OUTFLOWS OF EIGHT REGULATED LAKES IN THE OSWEGO RIVER BASIN, NEW YORK, 1930-79,
Geological Survey, Ithaca, NY. Water Resources Div.
For primary bibliographic entry see Field 2A.
W88-03010

ESTIMATION OF EVAPORATION FROM NED WILSON LAKE, FLAT TOPS WILDERNESS AREA, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2D.
W88-03040

HYDROLOGY OF LAKE JUNE IN WINTER, HIGHLANDS COUNTY, SOUTH-CENTRAL FLORIDA,
Geological Survey, Orlando, FL. Water Resources Div.
R. G. Belles, and E. H. Martin.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4303, 1985. 1 sheet (map), 9 fig, 5 tab, 13 ref.

Descriptors: *Lakes, *Rainfall, *Water quality, *Lake levels, *Florida, *Highlands County, Groundwater, Southwest Florida Water Management District.

Lake June in Winter is in central Highlands County near the town of Lake Placid in south-central Florida. Recreation and citrus-grove irrigation are the major uses of lake water. Land use around the lake is residential citrus, and undeveloped. Most of the land use in the 44-square mile lake-drainage area is undeveloped. The surface area of the lake is approximately 5.7 square miles with water-surface altitude average of 74 feet. The extremes in lake altitude for the period 1945-82 were 77.58 feet in October 1948, and 71.62 feet in May 1981. Flow into Lake June in Winter is from Lake Placid to the south through Catfish Creek. Flow out of the Lake is northward through Stearns Creek to Lake Francis, and eventually by Josephine Creek to Lake Istokpoga. The quality of water in Lake June in Winter is good. Specific conductance was found to be generally low, ranging between 90 umho/cm to 170 umho/cm, indicating a lack of dissolved solids present in the lake. The lake is clear, with transparency values between 3 and 14 feet. Total nitrogen was found to be 0.60 mg/L indicating a minimal effect from nitrogen fertilizer washoff or septic-tank discharge. (USGS)
W88-03053

FISHERY SURVEY AND RELATED LIMNOLOGICAL CONDITIONS OF WILLIAMS LAKE, HUBBARD COUNTY, MINNESOTA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8I.
W88-03063

WATER QUALITY ASSESSMENT OF ARVADA RESERVOIR, DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Denver, CO. Water Resources Div.
L. J. Britton, and N. G. Gaggiani.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-489, 1986. 200 p, 7 fig, 28 tab, 7 ref.

Descriptors: *Reservoirs, *Water quality, *Limnology, *Colorado, *Trophic level, Limiting nutrients, Data collections, Hydrologic data, Denver, Arvada Reservoir, Ralston Creek, Croke Canal.

Physical, chemical, and biological water quality data were collected and compiled for five sites in Arvada Reservoir, one site in Ralston Creek, and two sites in Croke Canal, in the Denver metropolitan area, Colorado. The purpose of the data collection was to determine the water quality of Arvada Reservoir, evaluate the effect of source waters on the reservoir, and determine the trophic state of the reservoir. Data collected include reservoir profile measurements with depth and inflow measurements of water temperature, specific conductance, dissolved oxygen, and pH. Secchi disk depth measurements also are reported. In addition, water samples were analyzed periodically for concentrations of major chemical constituents, nutrients, trace elements, and selected radiochemicals; for densities and relative abundance of phytoplankton and zooplankton; and for concentrations of chlorophyll alpha. Results of algal growth potential determinations are included. This report describes sampling site locations and methods of data collection and analyses and presents qualitative and quantitative results of water quality data collected during the study. Sampling began during June 1983 and continued through September 1985. (USGS)
W88-03128

CLIMATIC DATA FOR THE COTTONWOOD LAKE AREA, STUTSMAN COUNTY, NORTH DAKOTA, 1982,
Geological Survey, Lakewood, CO. Water Resources Div.
A. M. Sturrock, B. A. Hanson, J. L. Scarborough, and T. C. Winter.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-477, 1986. 24 p, 4 tab, 1 ref.

Descriptors: *Limnology, *Wetlands, *Climatic data, Evaporation, Heat budget, Precipitation, Prairie wetlands, North Dakota, Stutsman County, Cottonwood Lake area.

Research on the hydrology of the Cottonwood Lake area, Stutsman County, North Dakota, includes study of evaporation. Presented here are those climatic data needed for energy-budget and mass-transfer evaporation studies, including: water-surface temperature, sediment temperature dry-bulb and wet-bulb air temperatures, vapor pressure at and above the water surface, wind speed, and short- and long-wave radiation. Data were collected at raft and land stations. (USGS)
W88-03137

INVESTIGATIONS INTO THE USE OF LIMESTONE TO COMBAT ACIDIFICATION IN TWO LAKES IN WEST WALES,
Welsh Water Authority, Powys.
For primary bibliographic entry see Field 5G.
W88-03213

ECONOMIC VALUE OF WETLANDS SYSTEMS,
Louisiana State Univ., Baton Rouge. Dept. of Economics.
S. Farber, and R. Costanza.
Journal of Environmental Management JEVMAW, Vol. 24, No. 1, p 41-51, January 1987. 7 fig, 6 tab, 29 ref.

Descriptors: *Economic aspects, *Wetlands, *Water use, *Louisiana, Social aspects, Recreation demand, Storm protection, Water management, Resources management, Energy, Public policy, Water policy.

An economic willingness-to-pay (WTP) and an energy analysis (EA) method are used to establish the social value of a wetlands system. The economic approach considers the commercial, recreational, and storm protection value of wetlands. The energy analysis evaluates the energy processed by the wetlands system. These methods were applied to the wetlands system in South Louisiana. Estimates ranged from $590 per acre using WTP to $6,400-$10,000 per acre using EA. This range is quite large for management decisions. In the past, this uncertainty has caused managers to ignore the consumer value of wetlands and to make decisions based on other criteria. It is concluded that this is not adequate; more research is needed to increase the accuracy of these estimates, especially in storm flood protection, and option and existence values. Meanwhile, an estimate intended to minimize the chances of error should be adopted. The $590 per acre WTP estimate is probably an underestimate because it excludes several known wetlands services, while the higher EA estimates is probably high because they include wetland products that may not be economically valuable. (Doria-PTT)
W88-03214

CLIMATIC DATA FOR MIRROR LAKE, WEST THORNTON, NEW HAMPSHIRE, 1984,
Geological Survey, Lakewood, CO. Water Resources Div.
A. M. Sturrock, D. C. Buso, J. L. Scarborough, and T. C. Winter.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-134, 1986. 70 p, 4 tab, 1 ref.

Descriptors: *Evaporation, *Heat budget, *Climatic data, *Mirror Lake, *New Hampshire, Limnology, Data collections, Glacial Terrane, Appalachian Mountains.

Research on the hydrology of Mirror lake, (north-central) New Hampshire includes study of evaporation. Presented here are those climatic data needed for energy-budget and mass-transfer studies, including: temperature of lake water surface; dry-bulb and wet-bulb air temperatures; wind speed at 3 levels above the water surface; and solar and atmospheric radiation. Data are collected at raft and land stations. (USGS)
W88-03310

WATER-QUALITY VARIABILITY IN FOUR RESERVOIRS IN PHILLIPS AND VALLEY

COUNTIES, MONTANA, MAY THROUGH AUGUST, 1981,
Geological Survey, Helena, MT. Water Resources Div.
R. F. Ferreira, and J. H. Lambing.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4209, 1986. 85 p, 40 fig, 10 tab, 22 ref.

Descriptors: *Reservoirs, *Fish, *Water quality, *Montana, Lakes, Algae, Phytoplankton, Trace elements, Nutrients, Dissolved solids, Dissolved oxygen, Eutrophication, Photosynthesis, Respiration, Evaporation, Hydrologic data, Limnologic data, Limnology, Phillips County, Valley County.

Four reservoirs in Phillips and Valley Counties were studied from May to August, 1981 (1) to describe the variation in water quality that occurs from late spring (May) to late summer (August) and during 24-hrs in late summer and (2) to describe possible causes for the variation. All the reservoirs had distinct thermal gradients but lacked true stratification as a result of circulation induced by wind. Such mixing helps prevent oxygen depletion in bottom waters during the summer. The smallest dissolved-oxygen concentrations occurred in the near-bottom water of the reservoirs and during the night. Nighttime dissolved-oxygen concentrations in reservoirs 19 and 24 were much less than in reservoirs 1 and 9. Similar trends occurred with pH. Most chemical constituents in the water generally became more concentrated from May to August because of continuous water losses from evapotranspiration. This was noted by increase in the concentration of major dissolved constituents and by increase in specific conductance. All the reservoirs contained similar types of planktonic organisms, but in different proportions. Most of the fecal bacteria existing in the reservoirs presumably originated from livestock and waterfowl waste. (USGS)
W88-03316

WATER-QUALITY CHARACTERISTICS AND NUTRIENTS AND SUSPENDED-SEDIMENT LOADS, CARSON RIVER AND TRUCKEE CANAL, WESTERN NEVADA, WATER YEAR 1980,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03319

BENTHIC INVERTEBRATES IN SELECTED STREAMS OF THE PICEANCE CREEK BASIN, NORTHWESTERN COLORADO, WATER YEARS 1977-81,
Geological Survey, Meeker, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03323

PRELIMINARY RESULTS OF THE PREIMPOUNDMENT WATER-QUALITY STUDY OF SWATARA CREEK, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
D. K. Fishel, and J. E. Richardson.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4023, 1986. 84 p, 23 fig, 9 tab, 31 ref.

Descriptors: *Multipurpose reservoirs, *Water quality, *Acid mine drainage, *Swatara Creek, *Pennsylvania, Alkalinity, Acidity, Sediments, Metals, Nutrients, Ions, Bacteria, Base flow, High flow, Chemical stratification, Thermal stratification, Pine Grove, Lebanon County, Schuylkill County.

The preimpoundment water quality of Swatara Creek Reservoir, Pennsylvania, was studied from July 1981 through October 1982. Results from three sites indicate that during the 1982 water year, precipitation and streamflow were slightly below normal and 17,400 tons of suspended sediment were transported from the study area. About 46% of the annual load was transported during three days of high flow. Measured concentrations of alkalinity and acidity were usually less than 10 mg/L and 5 mg/L as CaCO3, respectively. The reservoir will probably be poorly buffered and inflows will transport high concentrations of nutrients and metals that will probably stratify in the lake. Maximum concentrations for dissolved nitrate and total phosphorus were 2.6 mg/L and 0.31 mg/L at Lower Little Swatara Creek, well above the concentrations needed for algal growth. Maximum concentrations for total iron, aluminum, and manganese were 100,000 microgram/L, 66,000 microgram/L, and 2,300 microgram/L, respectively, at Swatara Creek above Highway 895. The occurrence of high metal concentrations and simultaneous decreases in pH and increases in acidity indicate that mine drainage will degrade Swatara Creek. Iron, lead, copper, and zinc concentrations periodically exceeded U.S. Environmental Protection Agency (USEPA) criteria for freshwater aquatic life. Manganese and lead also exceeded USEPA criteria for domestic water supplies and human health, respectively. Low dissolved oxygen levels and high concentrations of dissolved metals in discharges from the planned reservoir may adversely affect downstream aquatic life. (USGS)
W88-03329

HYDROLOGY OF ISLAND FORD LAKE, HILLSBOROUGH COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
S. E. Henderson.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4135, 1986. 1 map report, 14 fig, 3 tab, 17 ref.

Descriptors: *Lakes, *Surface-groundwater relations, *Limnology, *Florida, *Island Ford Lake, *Maps, Bathymetry, Water quality, Hillsborough County, Brooker Creek.

Stage of Island Ford Lake, Florida, is controlled by gated inflow and outflow structures on Brooker Creek. Prior to 1976, outflow was controlled by a fixed-crest weir at elevation 40.0 ft. The mean stage for 1971-84, 39.9 ft above sea level, was equaled or exceeded 24% of the time during 1971-75 and 61% of the time during 1976-84. At a stage of 39.9 ft, the lake has an area of 91 acres, a volume of 965 acre-feet, and a mean depth of 10.6 ft. Maximum observed depth in the lake was 22.6 ft. Groundwater withdrawals from nearby public-supply well fields lower the potentiometric surface in the Upper Floridan aquifer and increase downward leakage from the lake to the aquifer. Water level analyses support model simulations indicating maximum permitted pumpage causes a drawdown of the potentiometric surface of 10 to 12 ft near the lake. Lowered groundwater levels have not affected Island Ford Lake stages but have decreased flow in Brooker Creek. Water quality samples indicate that lake waters are well mixed, soft, and with alkalinities of less than 3 mg/L. Pesticide concentrations were not detected in lake waters and concentrations of other constituents are typical of west-central Florida lakes. (USGS)
W88-03364

HYDROLOGY OF THE LAKE MIONA AREA, NORTHEAST SUMTER COUNTY, FLORIDA,
Geological Survey, Orlando, FL. Water Resources Div.
L. A. Bradner.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4002, 1986. 1 sheet (map), 7 fig, 2 tab, 20 ref.

Descriptors: *Lakes, *Aquifers, *Sinkholes, *Rainfall, *Evaporation, *Groundwater, *Lake levels, *Water quality, *Florida, Southwest Florida Water Management District, Sumter County, Lake Miona, Black Lake, Cherry Lake.

The Lake Miona area, in northeast Sumter County, is characterized by karstic depressions that contain lakes, ponds, and marshes that drain vertically to the upper Floridan aquifer. Lake Miona, Black Lake, and Cherry Lake are the prominent water features of the area. When the lake levels are lowest, the lakes are not connected, but at higher levels, they become connected and water flows eastward from Lake Miona through Black Lake to Cherry Lake. The chemical and biological conditions in the lakes are such that, although they support a large population of submerged aquatic plants, no problem with algae blooms was observed. (USGS)
W88-03439

HYDROLOGY OF LAKE BUTLER, ORANGE COUNTY, FLORIDA,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03448

HYDROLOGY OF LAKE PLACID AND ADJACENT AREA, HIGHLANDS COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03470

RECOVERY OF HIGH NUMBERS OF BDELLOVIBRIOS FROM THE SURFACE WATER MICROLAYER,
Maryland Univ., Baltimore. Dental School.
H. N. Williams.
Canadian Journal of Microbiology CJMIAZ, Vol. 33, No. 6, p 572-575, June 1987. 1 tab, 13 ref. NSF Grant R11-8411310.

Descriptors: *Bdellovibrios, *Surface water, *Microlayers, *Recovery, *Isolation, *Bacteria, Ecosystems, Ecology.

Bdellovibrios lytic against the bacterium Vibrio parahaemolyticus have been recovered in the surface water microlayer. The organisms were recovered at numbers several 100-fold higher than the number recovered from subsurface waters, the aquatic area where most quantitative studies for bdellovibrios have been conducted. The number of total cultivable bacteria recovered in the surface water microlayer exceeded by several logs the number of cultivable bacteria recovered from subsurface waters. The results of this study reveal that bdellovibrios can be recovered in the aquatic environment at higher numbers than some previous studies have indicated. The high numbers of bdellovibrios and other bacteria recovered from the surface water microlayer makes this an attractive ecosystem in which to study the ecology of bdellovibrios in the aquatic environment. (Author's abstract)
W88-03474

ASSESSMENT OF CHEMICAL AND BIOLOGICAL SIGNIFICANCE OF ARSENICAL SPECIES IN THE MAURICE RIVER DRAINAGE BASIN (N.J.). PART I. DISTRIBUTION IN WATER AND RIVER AND LAKE SEDIMENTS,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5A.
W88-03475

ASSESSMENT OF CHEMICAL AND BIOLOGICAL SIGNIFICANCE OF ARSENICAL SPECIES IN THE MAURICE RIVER DRAINAGE BASIN (N.J.). PART II. PARTITIONING OF ARSENIC INTO BOTTOM SEDIMENTS,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5A.
W88-03476

ASSESSMENT OF CHEMICAL AND BIOLOGICAL SIGNIFICANCE OF ARSENICAL COMPOUNDS IN THE MAURICE RIVER DRAINAGE BASIN (N.J.). PART III. TRANSFORMATIONS IN AEROBIC AND ANAEROBIC CONDITIONS,
Cook Coll., New Brunswick, NJ. Dept. of Envi-

ronmental Science.
For primary bibliographic entry see Field 5B.
W88-03477

CHEMICAL AND ECOLOGICAL EFFECTS OF A PENNINE PEAT-SLIDE,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
C. P. McCahon, P. A. Carling, and D. Pascoe.
Environmental Pollution EPEBD7, Vol. 45, No. 4, p 275-289, 1987. 3 fig, 3 tab, 56 ref.

Descriptors: *Landslides, *Peat-slides, *Ecological effects, *River Tees, Fish kills, Heavy metals, Rainfall, Storms, Rivers, Peat, Fish.

A peat landslide which occurred in Upper Teesdale in 1983 is described. The slide followed thunderstorm rainfall of a very rare intensity (104.8 mm in 2.5 h) and a long predicted return period (2500 years). A large mass of peat (30,000 tons wet weight) entered the headwaters of the River Tees, resulting in chemical changes such as increases in suspended solids, iron, aluminum and lead in the river, and a consequent fish kill. The probable cause of the fish kill was the high suspended solid content (particularly peat and iron hydroxide) of the flood water. Effects on the invertebrate fauna of the River Tees are also considered. (Author's abstract)
W88-03481

FATE OF METAL CONTAMINATED SEDIMENTS IN FOUNDRY COVE, NEW YORK,
State Univ. of New York at Stony Brook. Dept. of Ecology and Evolution.
For primary bibliographic entry see Field 5B.
W88-03482

QUALITATIVE AND QUANTITATIVE AQUATIC ALGAL DATA COMPILATION TO DETERMINE MACROTRENDS,
Arkansas Univ., Fayetteville. Dept. of Botany and Microbiology.
R. L. Meyer.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-151511/AS. Price codes: A02 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville. Pub. No. 114, September 1985. 7 p. Contract No. 14-08-0001-G893. Project No. USGS G893-22.

Descriptors: *Arkansas, *Lakes, *Eutrophication, *Data collections, *Limnologic data, *Algae.

A data base of the algae of Arkansas has been initiated by the selection of a relational data base management system. The system was chosen to be readily available for microcomputers using MS-or PC-DOS. The initial parameters chosen for entry are associated with the classification of the organisms from Class to Variety level with author and year of initiation. Further annotation includes identification source. Presently, the data base of 1,162 taxa includes 226 Cyanophyceae, 367 Chlorophyceae, 124 Euglenophyceae, 26 Xanthophyceae, 81 Chrysophyceae, 279 Bacillariophyceae, 33 Pyrrophyceae, 14 Cryptophyceae, and 5 Rhodophyceae. These taxa are sortable by any of the included parameters. The data base will be archived as a portion of the flora and fauna series of the state of Arkansas. (Meyer-WRRC-University of Arkansas, Fayetteville)
W88-03487

2I. Water In Plants

PLANT DISEASES ASSOCIATED WITH MUNICIPAL WASTEWATER IRRIGATION,
Michigan State Univ., East Lansing. Dept. of Botany and Plant Pathology.
L. Epstein, and G. R. Safir.
IN: Land Treatment of Municipal Wastewater: Vegetation Selection and Management. Ann Arbor Science, Ann Arbor, MI. 1982. p 195-203, 35 ref.

Descriptors: *Wastewater disposal, *Plant diseases, *Plant pathology, *Wastewater irrigation, *Irrigation effects, Nutrient removal, Land disposal, Vegetation effects, Bacteria, Fungi.

In wastewater irrigated systems, the greatest plant disease problems may be associated with Pythium and Phytophthora root rots. These pathogens seem most prevalent in wet soils, making irrigation management critical to the survival of vegetation. Phytophtora root rot of alfalfa can be a serious problem in poorly drained areas. Soil saturation prior to inoculation predisposes alfalfa to phytophthora root rot. and subsequent additional water enhances disease development. Assuming the wastewater used in irrigation projects neither contains pathogens nor serves as a nutrient source for microbes, then the primary effects of wastewater irrigation on plant disease are most likely the same as those caused by irrigation alone. Wastewater irrigation project managers should be aware that excessive moisture generally promotes plant disease, and that an uncultivated area with high plant disease can serve as a source of inoculum and as a reservoir for pathogens which can attack economically important hosts. (See also W88-02741) (Geiger-PTT)
W88-02753

SURFACE GEOMETRY AND STOMATAL CONDUCTANCE EFFECTS ON EVAPORATION FROM AQUATIC MACROPHYTES,
Arizona State Univ., Tempe.
For primary bibliographic entry see Field 2D.
W88-02781

COMPARATIVE ABILITIES OF LEAF SURFACES TO NEUTRALIZE ACIDIC RAINDROPS: I. THE INFLUENCE OF CALCIUM NUTRITION AND CHARCOAL-FILTERED AIR,
Toronto Univ. (Ontario). Dept. of Botany.
T. C. Hutchinson, and C. M. Adams.
New Phytologist NEPHAV, Vol. 106, No. 1, p 169-183, May 1987. 3 fig, 5 tab, 43 ref.

Descriptors: *Leaves, *Plant physiology, *Plant tissues, *Acid rain, *Rain, *Water pollution effects, *Neutralization, *Hydrogen ion concentration, Precipitation, Particulate matter, Calcium, Filtered air.

The relative abilities of four species to neutralize acidic rain droplets placed on their leaf surfaces were examined. Rain droplets (50 microliters) of pH 4.7, 3.8, 3.0, and 2.4 were used. Determinations of droplet pH on the leaf surfaces and on a control parafilm surface were made at intervals until the leaves dried. Neutralizing abilities of leaves of sugar beet (Beta vulgaris), radish (Raphanus sativus), sunflower (Helianthus annuus) and the arctic herb (Artemisia tilesii) were compared. The plants were grown in sand culture with calcium supplied at a range of five concentrations, from 4.8 to 480 ppm to alter the calcium status of the foliage. While the Ca(2+) treatments strongly influenced the Ca(2+) content of the leaves, they did not influence the neutralizing ability of the leaves. However, sugar beet, which showed the least ability to neutralize, had the lowest foliar Ca(2+) content of the species examined. At raindrop pH values of 4.7, 3.8 and 3.0, the species were all able to increase droplet pH substantially before drying. The effect appeared to be two-phased, with a rapid initial neutralization probably due to solubilized surface particulates and evaporated leaf exudates, followed by a slower subsequent phase, probably due to droplet-cell wall exchange processes. At pH 2.4 only radish and sunflower were still able to neutralize, but this may have been due to leakage of the contents of damaged cells. In experiments comparing plants grown in filtered versus unfiltered air, and sand versus soil in the greenhouse or outdoors, it was shown that charcoal filtering the air substantially reduced the neutralizing ability of the leaf surface. Surface wettability and the speed at which droplets dried out were important in determining the neutralizing ability of leaf surfaces. (Author's abstract)
W88-02794

DETERMINANTS OF PATTERN IN A NEW ENGLAND SALT MARSH PLANT COMMUNITY,
Brown Univ., Providence, RI. Graduate Program in Ecology and Evolutionary Biology.
M. D. Bertness, and A. M. Ellison.
Ecological Monographs ECMOAQ, Vol. 57, No. 2, p 129-147, June 1987. 9 fig, 4 tab, 70 ref. NSF Support BSR 82-05747, BSR 83-13303, and BSR85-16992.

Descriptors: *Plant morphology, *Plant populations, *Salt marshes, *Tidal marshes, Marshes, New England, Morphology, Vegetation, Salinity, Rhode Island, Plant physiology, Zones.

The spatial organization of a New England salt marsh plant community located in Rhode Island was examined using observational and experimental methods. The distribution of plants and edaphic factors across the marsh community were described and the results of transplant studies to test the hypothesis that plant distributions correspond to their physical tolerances were reported. The spatial and temporal pattern of the mats of dead plant material (wrack) disturbances and its impact on plant species abundance in the community were examined. Spartina alterniflora dominated the low-marsh habitat which was covered daily by tides, while the high-marsh habitat which was not flooded daily was dominated on its seaweed border by Spartina patens, and on its terrestrial border by Juncus gerardi. Each of these vegetation zones had characteristic physical factors associated with differences in tidal inundation which contributed to the vegetation patterns. However, the transplant studies showed that the S. alterniflora was capable of growing across the entire marsh, but was excluded from the high-marsh habitat by the high-marsh perennials. Differential plant mortality resulting from short-term disturbance events and burial under wrack affected plant abundance seasonally since wrack was rafted by tides most severely in the spring and early summer. Physical disturbance and interspecific competition appeared to major determinants of the spatial pattern of marsh plant communities. (Wood-PTT)
W88-02797

NUTRIENT REMOVAL FROM EFFLUENTS BY AN ARTIFICIAL WETLAND: INFLUENCE OF RHIZOSPHERE AERATION AND PREFERENTIAL FLOW STUDIED USING BROMIDE AND DYE TRACERS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Centre for Irrigation Research.
For primary bibliographic entry see Field 5D.
W88-02830

GROWTH HABITS OF WATER-STRESSED WHEAT SEEDLINGS AS SELECTION CRITERIA FOR DROUGHT RESISTANCE,
Department of Agriculture, Lethbridge (Alberta). Research Station.
For primary bibliographic entry see Field 3F.
W88-02875

IRRIGATION EVALUATIONS AND IMPROVEMENTS IN NEW MEXICO TO CONSERVE WATER AND ENERGY,
New Mexico Water Resources Research Inst., Las Cruces.
For primary bibliographic entry see Field 3F.
W88-02966

WATER STORAGE AND USE BY SPRING WHEAT UNDER CONVENTIONAL TILLAGE AND NO TILL IN CONTINUOUS AND ALTERNATE CROP-FALLOW SYSTEMS IN THE NORTHERN GREAT PLAINS,
North Dakota State Univ., Fargo.
For primary bibliographic entry see Field 3F.
W88-03210

SALT TOLERANCE OF FOUR TOMATO HYBRIDS,
Centro de Edafologia y Biologia Aplicada del Segura, Murcia (Spain).
For primary bibliographic entry see Field 3C.

W88-03216

DISTRIBUTION, LENGTH AND WEIGHT OF ROOTS IN YOUNG PLANTATIONS OF EUCALYPTUS GRANDIS W. HILL EX MAIDEN IRRIGATED WITH RECYCLED WATER,
Victoria Dept. of Conservation, Forests and Lands, State Forests and Lands Service, Melbourne (Australia).
For primary bibliographic entry see Field 3C.
W88-03217

2J. Erosion and Sedimentation

SEDIMENTATION AND EFFLUENT CONCENTRATION OF SOFT CLAY ON RECLAMATION WORKS,
Japan Bottom Sediment Management Association, Tokyo.
Y. Watari, N. Aritomi, and N. Morii.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 26-47, 24 fig, 4 tab.

Descriptors: *Waste disposal, *Effluents, *Sedimentation, *Clay, *Model studies, *Path of pollutants, Suspended solids, Flocculation, Cylinder tests, Flow patterns, Magnesium, Sodium, Metals, Particle size.

A basic design standard is given for the disposal of effluents in a containment area. Field investigations and model tests were conducted to clarify the flow patterns and settlements of the discharged material. By considering the results obtained by these investigations, a method was derived for estimation for effluent suspended solids (SS) concentration during dredging and reclamation works. In dredged mixtures: (1) the settling velocity of particles in seawater is greater than in fresh water due to the flocculation of negatively charged sediment particles into Mg(++) or Na(+) in seawater; (2) Flow patterns of the dredged mixture are considerably affected by the sedimentation of large-sized particles. Smaller particles accumulate in proportion to the distance from the outlet; (3) Clarified water concentration at the spillway is affected by variations in the flow pattern; and (4) water content at 50 cm below the sedimentation surface was 200% to 450%. In a cylinder test: (1) zone settling can be observed when influent concentrations are more than 10,000 mg/L, but in the case of an initial concentration less than 10,000 mg/L, flocculent settling can be observed; (2) the clarified water SS concentrations become nearly equal after about 30 min. of settlement, independent of the initial concentration; and (3) the diameter of the cylinder has no effect on the settling pattern of the clarified water SS concentration within the range of tested diameters. (See also W88-02513) (Lantz-PTT)
W88-02516

COMMENCEMENT BAY - A REMEDIAL INVESTIGATION OF CONTAMINATED SEDIMENTS IN A MARINE ENVIRONMENT,
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 5B.
W88-02517

MOVEMENT OF SEDIMENT UNDER A PROGRESSIVE WAVE,
Japan Dredging and Reclamation Engineering Association, Tokyo.
M. Gomyoh, E. Yauchi, and H. Kojima.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 220-232, 14 fig, 1 tab, 4 ref.

Descriptors: *Sediment transport, *Waves, *Progressive waves, Bottom sediments, Sediments, Waves, Suspended sediment, Mathematical studies, Oscillatory waves.

Bottom sediments in the shallow sea and in-bay have very high water and organic matter content. These sediments are easily resuspended and settled, and flow easily under tidal currents or waves. These phenomena have caused many environmental problems, such as water pollution and decreased fairway depth in harbors and bays. In order to solve these problems, an hydraulic experiment on the movement of sediment under a progressive wave was carried out under differing conditions of water content. It was found that the length of the sediment ripple on the interface between the water layer and sediment layer, the wave height of sediment oscillation, and the attenuation rate of progressive wave height reached maximum values when the water content was about around 247% to 250%. Further, these characteristics could be evaluated by a nondimensional number phi (= (dividend of theta/2 x nu sediment) x d) which was obtained from the thickness of both laminar boundary layer and sediment. (See also W88-02513) (Author's abstract)
W88-02528

ANALYTICAL SURVEY OF ACCUMULATIONS OF SEDIMENTS IN CANALS OF TOKYO PORT,
Bureau of Ports and Harbors, Tokyo (Japan).
S. Kimura, T. Naganuma, and S. Wano.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 245-261, 7 fig, 5 tab, 7 ref.

Descriptors: *Sediment concentration, *Tokyo Port, *Dredging, *Sedimentation, Chemical oxygen demand, Bottom sediments, Sediment sorting, Phytoplankton, Aquatic vegetation, Organic compounds, Chemical analysis.

The canal beds around the Tokyo port are covered with thick oozy sediments including floating sediments. These sediments often cause not only traffic problems but also environmental problems. In order to remove the sediments, a dredging project has been conducted. In order to perform the project effectively, observations and analyses were carried out to identify sediment characteristics, sediment sources, sediment supply, and sedimentation rates. The thickness of oozy sediments ranged from 60 to 80 cm, and the color of the sediments was black due to the highly unaerobic conditions. The characteristic values of bottom sediments, the water content, the ignition loss and chemical oxygen demand, were about 200%, 10%, and 40 mg/g, respectively. These values indicate that the sediments contain alot of organic substances. To estimate the rate of sedimentation, samples were collected in two ways, short-term (1 day) collections and long-term (3 years) collections. The former method gave a considerably high rate of about 20 cm/yr, and the latter gave a lower rate of 1.5 cm/yr. However, direct observations of the sedimentation rate provided a range of 1.6 to 11.4 cm/yr. The major sources of the sediment are rivers (48% of the total load to the canals), phytoplankton productions (37%), and sewerage plants (15%). (See also W88-02513) (Author's abstract)
W88-02530

USE OF ANTI-TURBIDITY CURTAINS AT A SAND COMPACTION PILING AREA IN YOKOHAMA HARBOUR,
Japan Bottom Sediment Management Association, Tokyo.
For primary bibliographic entry see Field 5G.
W88-02532

BANK PROTECTION, BASS LOCATION, WILLAMETTE RIVER, OREGON: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8B.
W88-02562

CONCENTRATION AND FLUX PROFILES OF PCBS, DDTS AND PAHS IN A DATED SEDIMENT CORE FROM THE LAGOON OF VENICE,
Venice Univ. (Italy). Facolta di Chimica Industriale.
For primary bibliographic entry see Field 5B.
W88-02675

TILTED-BED SIMULATION OF EROSION AND CHEMICAL RUNOFF FROM AGRICULTURAL FIELDS: I. RUNOFF OF SEDIMENT AND SEDIMENT-ASSOCIATED COPPER AND ZINC,
Agricultural Research Service, Tifton, GA. Southeast Watershed Research Center.
For primary bibliographic entry see Field 5B.
W88-02715

TILTED-BED SIMULATION OF EROSION AND CHEMICAL RUNOFF FROM AGRICULTURAL FIELDS: II. EFFECTS OF FORMULATION ON ATRAZINE RUNOFF,
Agricultural Research Service, Tifton, GA. Southeast Watershed Research Center.
For primary bibliographic entry see Field 5B.
W88-02716

ACCURACY OF SEDIMENT DEPOSITION ESTIMATION,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
A. Bardossy, I. Bogardi, and L. Duckstein.
Water Resources Research WRERAQ, Vol. 23, No. 6, p 1021-1026, June 1987. 2 fig, 2 tab, 28 ref, append. Food and Agriculture Organization Project HUN82004.

Descriptors: *Sedimentation, *Sediment deposition, *Sediments, *Estimating, *Silting, *Statistical models, *Data interpretation, *Statistical analysis, *Reservoirs, *Model studies, Mathematical studies, Mathematical equations, Error analysis, Deposition.

A statistical model is developed for the error analysis of surveying sediment deposition in reservoirs. The estimation variance of both volume and weight of deposition can be calculated from a simple expression. The calculated error is shown to depend on inherent spatial variability, type of measurement, and the number of survey points. Survey networks for six reservoirs were designed by the model in such a way that the total weight of deposition could be measured with a coefficient of variation in the range 0.02-0.06. (Author's abstract)
W88-02779

FLOOD GEOMORPHOLOGY OF THE KATHERINE GORGE, NORTHERN TERRITORY, AUSTRALIA,
For primary bibliographic entry see Field 2E.
W88-02793

MOBILIZATION BEHAVIOR OF THALLIUM AND CADMIUM IN A RIVER SEDIMENT-(MOBILISATIONSVERHALTEN VON THALLIUM UND CADMIUM IN EINEM FLUSS SEDIMENT),
Indian Inst. of Tech., New Delhi. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W88-02855

RESERVOIR BANK EROSION CAUSED AND INFLUENCED BY ICE COVER,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 2C.
W88-02889

NOTES ON SEDIMENTATION ACTIVITIES: CALENDAR YEAR 1984.
Geological Survey, Reston, VA. Office of Water Data Coordination.
For primary bibliographic entry see Field 4D.
W88-02964

NOTES ON SEDIMENTATION ACTIVITIES: CALENDAR YEAR 1983.

Geological Survey, Reston, VA. Office of Water Data Coordination.
For primary bibliographic entry see Field 4D.
W88-02965

CONTRIBUTIONS OF SUSPENDED SEDIMENT FROM HIGHWAY CONSTRUCTION AND OTHER LAND USES TO THE OLENTANGY RIVER, COLUMBUS, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-02978

THEORY AND OPERATION MANUAL FOR THE AUTOPIPET, SEMI-AUTOMATIC PIPET WITHDRAWAL APPARATUS,
Geological Survey, Minneapolis, MN. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03007

DEVELOPMENT OF A BAG-TYPE SUSPENDED-SEDIMENT SAMPLER,
Geological Survey, Minneapolis, MN. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03008

1980 POLLALLIE CREEK DEBRIS FLOW AND SUBSEQUENT DAM-BREK FLOOD, EAST FORK HOOD RIVER, OREGON,
Geological Survey, Vancouver, WA. Water Resources Div.
G. L. Gallino, and T. C. Pierson.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Supply Paper 2273, 1985. 22 p, 18 fig, 5 tab, 23 ref.

Descriptors: *Flash floods, *Flood waves, *Debris flows, *Mount Hood, *Oregon, *Dam breaks, Channel morphology, Computer models.

On December 25, 1980, a landslide at the head of Polallie Creek Canyon was transformed rapidly into a debris flow, which surged down the channel to the confluence with the East Fork Hood River, where the debris flow deposited approximately 100,000 cu yd of saturated, poorly sorted debris to a maximum thickness of 35 ft, forming a 750 ft long temporary dam across the channel. Within approximately 12 minutes, a lake of 85 acre-feet formed behind the blockage, breached the dam, and sent a flood wave down the East Fork Hood River. The combined debris flow and flood resulted in one fatality and over $13 million in damage to a highway, bridges, parks, and a water-supply pipeline. Application of simple momentum- and energy-balance equations, and uniform flow equations resulted in debris flow peak discharges ranging from 50,000 cu ft/s to 300,000 cu ft/s at different locations in the Polallie Creek canyon. When the volume of the solid debris was subtracted out, a minimum peakwater discharge of 40,000 cu ft/s was obtained. A computer dambreak model simulated peak flow for the outbreak flood on the East Fork Hood River in the range of 20,000 to 30,000 cu ft/s using various breach shapes and durations of breach between 5 and 15 minutes. A slope conveyance computation of 0.25 mi downstream from the dam gave a peak water discharge (solids subtracted out) for the debris-laden flood of 12,000 to 20,000 cu ft/s, depending on the channel roughness coefficient selected. (USGS)
W88-03104

UNIVERSAL SOIL LOSS EQUATION AND THE SOIL LOSS ESTIMATION MODEL FOR SOUTHERN AFRICA: CONCEPTS, VARIABLES AND AREAL APPLICATION,
Department of Agricultural Technical Services, Pretoria (South Africa). Div. of Agricultural Engineering.
A. A. Smithen, and R. E. Schulze.
University of Natal Agricultural Catchments Research Unit Report No 7, Part 1 - Field Studies, Data Processing, Techniques and Models for Applied Hydrological Research - Vol 1, p 298-325, 1979. 14 fig, 1 tab, 15 ref.

Descriptors: *Soil erosion, *Mathematical models, *Erosion rates, Forecasting, Rainfall rate, Soil types, Land management, Topography, Model studies, Kinetic energy, Slopes, Erosion control, Mapping, Rainfall distribution, Cedara, USLW, SLEMSA.

Chapter 13 of Section D: Hydrological Studies of Soil Loss, deals with an areal application of the USLE (Universal Soil Loss Equation) and the SLEMSA (Soil Loss Estimation Model for Southern Africa), which were both used to produce maps showing the erosion potential of three small agricultural catchments at Cedara. A first estimate of soil loss can be obtained with either model and the choice of the one applied remains subjective. In general the USLE predicted higher values than SLEMSA. (USGS)
W88-03105

CONTRIBUTION OF RAINFALL EROSIVITY FROM THUNDERSTORMS IN NATAL,
Natal Univ., Pietermaritzburg (South Africa).
R. E. Schulze, and M. L. Easter.
University of Natal Agricultural Catchments Research Unit Report No 7, Part 1 - Field Studies, Data Processing, Techniques and Models for Applied Hydrological Research - Vol 1, p 326-344, 1979. 8 fig, 2 tab, 6 ref.

Descriptors: *Soil erosion, *Erosion rates, *Mathematical models, Rainfall rate, Erosion control, Thunderstorms, Storm runoff, Rainfall intensity, Soil conservation, Decision making, South Africa, Natal.

Chapter 14 of Section D: Hydrological Studies of Soil Loss, aims at assessing, spatially and temporally, the contribution of rainfall erosivity from thunderstorms in Natal, applying the Universal Soil Loss Equation and the Soil Loss Estimation Model for Southern Africa. Records of at least 5 years' duration from 10 autographic raingages located in seven bioclimatic regions throughout Natal and analyzed by the break-point digitizing technique (Chapter 5) to a resolution of two minutes, were used. While yielding only 30 percent of the rainfall, thunderstorms in Natal account for some 80 percent of the rainfall erosivity. Preliminary maps of thunderstorms erosivity indices were prepared for Natal illustrating that, all other factors being equal, certain areas were four times as prone to erosion from thunderstorm rainfalls than other areas. (USGS)
W88-03106

EFFECTS OF GRAVITATIONAL AND EARTHQUAKE FORCES ON THE STABILITY OF THE SOUTH FORK CASTLE CREEK BLOCKAGE IN THE MOUNT ST. HELENS AREA, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 8D.
W88-03108

CHANNEL WIDENING CHARACTERISTICS AND BANK SLOPE DEVELOPMENT ALONG A REACH OF CANE CREEK, WEST TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
A. Simon, and C. R. Hupp.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. Available from USGS, OFFSS, Box 25425, Denver, CO 80225. Supt Doc, USGPO, Wash, DC 20402. In: USGS Water-Supply Paper 2290, 1986. p 113-126, 10 fig, 3 tab, 11 ref.

Descriptors: *Channel erosion, *Channel morphology, *Vegetation establishment, *Tennessee, Rivers, Soil mechanics, Channelization, Lauderdale County.

Channelization and its related effects have led to 17 feet of degradation and 150 feet of widening of Cane Creek at Hunter Road, from 1970 to 1983. The causes of widening are (1) overheightening of the loess channel banks beyond the critical bank height (Hc) by incision and (2) deflection of flow towards the right bank of entrapped trees from upstream bank failures resulting in severely scalloped banks on the outside bends of the high flow-thalweg. Tree-ring evidence and channel-geometry data indicate an average bank-widening rate of about 4 feet per year. Widening occurs predominantly by initial detachment from the bank by slab failure followed by deep-seated rotational failures on the upper banks. Piping and tension-crack development play important roles in these processes. Estimates of further channel widening over the short-term (10 to 20 years) range from 23 feet to approximately 60 feet. The slough-line angle, used as a measure of temporary stability in the development of the reach's banks, is diagnostic in determining amounts of widening. The slough-line angle has probably flattened from an angle equal to its angle of internal friction (approximately 26 degrees) to its present inclination (about 20 degrees), and should continue to flatten as Cane Creek develops a new flood plain at an elevation lower than its present one. (USGS)
W88-03122

EVALUATION OF NITROGEN APPLICATION TECHNIQUE AND TILLAGE SYSTEM ON NITROGEN RUNOFF FROM AN ERODIBLE SOIL,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W88-03172

RISK OF LEAVING THE SOIL SURFACE UNPROTECTED AGAINST FALLING RAIN,
Shahid Chamran Univ., Ahvaz (Iran). Dept. of Soil Science.
H. Ghadiri, and D. Payne.
Soil & Tillage Research SOTRD5, Vol. 8, No. 1-4, p 119-130, November 1986. 8 fig, 2 tab, 13 ref.

Descriptors: *Soil surfaces, *Rainfall impact, *Protection, *Soil erosion, *Erosion control, *Rainfall, Erosion, Stress, Shear stress, Photography, Aggregates, Soil aggregates, Soil science, Kinetic energy, Slopes, Soil water, Soil stability.

Raindrop impact, splash, and cratering were studied quantitatively by photographic and nonphotographic methods in order to understand the mechanism of rain erosion of soil. Results show that even in the case of small drops falling onto stable aggregates, most of the splashed droplets formed were loaded with soil material. Compressive stress of falling raindrops and shear stress caused by flowing water after impact were calculated using the water-hammer theory and equation together with the measurement of lateral and upward speed on the corona on the films. Lateral flow of water after impact with a speed several times greater than impact velocity caused very high shear stress around the perimeter of the impact area. Results show that the erosive power of raindrops is much higher than suggested by kinetic energy, and there is no nonerosive rain. Therefore, there is a great risk in leaving the soil surface unprotected, even for soils with stable aggregates. The effects of factors such as aggregate stability, degree of soil wetness, thickness of the water film on the soil surface, degree of slope, and surface roughness are discussed. (Doria-PTT)
W88-03193

MODELING SOIL EROSION, TRANSPORT AND DEPOSITION,
City Coll., New York.
For primary bibliographic entry see Field 2J.
W88-03196

MODELING SOIL EROSION, TRANSPORT AND DEPOSITION,
City Coll., New York.
R. M. Khanbilvardi, and A. S. Rogowski.
Ecological Modelling ECMODT, Vol. 33, No. 2-4, p 255-268, October 1986. 10 fig, 2 tab, 22 ref.

Descriptors: *Model studies, *Soil erosion, *Mathematical studies, *Simulation analysis, *Sediment transport, *Sedimentation, Erosion, Rill erosion, Sediments, Estimating equations, Prediction, Flow, Storms, Model testing, Watersheds, Agricultural watersheds, Sediment yield, Scour.

The mathematical simulation of erosion on upland areas is described. The erosion process is divided into rill and interrill components according to the source of eroded sediment. The model provides estimates of sediment yield, predicts flow patterns, delineates partial contributing areas, and shows principal zones of deposition. The model permits changes in parameter values from storm to storm and allows a distribution of soil characteristics over an area. It predicts patterns of sediment and water flow as well as the amounts of soil lost from rill channels by scour and from contributing areas by detachment. The model was executed for more than 30 storm events on two agricultural watersheds in Nebraska. Results suggest that the model can produce satisfactory agreement between predicted and measured values of sediment yield, and may prove to be a practical tool to analyze the influence of varying the particle size, role of sediment delivery ratio, and alternate management practices. (Doria-PTT)
W88-03196

RANDOM FIELD MODELLING OF SPATIAL VARIATIONS IN EROSION AND DEPOSITION IN FLAT ALLUVIAL LANDSCAPES IN ARID CENTRAL AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Alice Springs (Australia). Div. of Wildlife and Rangelands Research.
G. Pickup, and V. H. Chewings.
Ecological Modelling ECMODT, Vol. 33, No. 2-4, p 269-296, October 1986. 8 fig, 6 tab, 27 ref.

Descriptors: *Model studies, *Spatial distribution, *Erosion, *Sedimentation, *Alluvial plains, *Australia, *Arid lands, Distribution, Forecasting, Remote sensing, Satellite technology, Stochastic process.

A study was undertaken to detect, describe, and forecast spatial patterns of erosion and deposition on a broad scale using remotely sensed data from Landsat that have been transformed to produce an index of erosion and deposition intensity. The stochastic process used is a simultaneous autoregressive spatial model defined on a finite lattice. Methods are described for fitting the model, generating synthetic data, and obtaining input data by deconvolution for use in subsequent forecasting with another model. Studies of test areas in central Australia indicate that a first order, 8-neighborhood model structure is the most appropriate, and that there are consistent changes in model parameter values as the amount of erosion increases in a landscape. It is concluded that if the input series for a particular area may be derived, the model for a more eroded condition may be applied to obtain a forecast of the spatial patterns that would occur if the area should suffer more intense erosion. (Doria-PTT)
W88-03197

DEFINING EROSION POTENTIAL ON CROPLAND: A COMPARISON OF THE LAND CAPABILITY CLASS-SUBCLASS SYSTEM WITH RKLS/T CATEGORIES,
Economic Research Service, Washington, DC. Natural Resource Economics Div.
L. K. Lee, and J. J. Goebel.
Journal of Soil and Water Conservation JWSCA3, Vol. 41, No. 1, p 41-44, January-February 1986. 1 fig, 4 tab, 10 ref.

Descriptors: *Erosion, *Cropland, *Mathematical equations, *Planning, *Soil classification, Environmental policy, Soil erosion, Classification, Rill erosion, Sheet erosion, Cultivation.

Land capability class-subclass designations and the physical factors of the universal soil loss equation (RKLS categories) are compared for categorization of erodible lands. The ratio of RKLS divided by the soil loss tolerance (T) is used to define three categories of erosion potential on cropland. Land capability class-subclass and RKLS/T categories are compared in 17 major land resource areas where wind erosion is not a major problem. Data suggest that the capability class-subclass system identifies the most erodible soils with the subclass e designation. Within a given region, the system also provides a consistent, progressive ranking of soils with increasing physical limitations for use due to erosion. But the land capability class-subclass system does not provide a uniform erodibility ranking across regions or a precise categorization of highly erodible soils. (Author's abstract)
W88-03209

MULTIVARIATE GEOCHEMICAL INVESTIGATION OF TRACE METAL POLLUTION IN KUWAIT MARINE SEDIMENTS,
Kuwait Inst. for Scientific Research, Safat.
For primary bibliographic entry see Field 5B.
W88-03291

COASTAL EROSION AND SEA LEVEL RISE: IMPLICATIONS FOR OCEAN BEACH AND SAN FRANCISCO'S WESTSIDE TRANSPORT PROJECT,
Harvard Univ., Cambridge, MA. Dept. of Economics.
P. J. Wilcoxen.
Coastal Zone Management Journal CZMJBF, Vol. 14, No. 3, p 173-191, 1986. 9 fig, 5 tab, 12 ref.

Descriptors: *Beach erosion, *Coastal erosion, *Sea level, *Model studies, *Planning, *Erosion forecasting, *California, San Francisco, Ocean Beach, San Francisco Westside Sewer Transport, Damage, Prediction, Forecasting, Water level, Erosion, Accelerated erosion, Erosion control, Beaches, Shores, Mathematical equations.

One of the consequences of sea level rise resulting from the greenhouse effect is increased coastal erosion. A model of erosion that can be used to estimate the response of beaches to sea level rise is discussed. The model is applied to Ocean Beach, California, with particular attention to the consequences of accelerated erosion for the San Francisco Westside Sewer Transport. Results obtained show that erosion produced by accelerated sea level rise could cause substantial damage to the structure. Large expenditures on beach nourishment will be required to protect the transport and the recreational value of the beach. (Author's abstract)
W88-03294

PROGRESS REPORT ON THE EFFECTS OF HIGHWAY CONSTRUCTION ON SUSPENDED-SEDIMENT DISCHARGE IN THE COAL RIVER AND TRACE FORK, WEST VIRGINIA 1975-81,
Geological Survey, Charleston, WV. Water Resources Div.
For primary bibliographic entry see Field 4C.
W88-03324

FLOOD CHANNEL GEOMETRY, ELEVATIONS, AND FLOOD MAPS, LOWER TOUTLE AND COWLITZ RIVERS, WASHINGTON, JUNE 1980 TO MAY 1981,
Geological Survey, Tacoma, WA. Water Resources Div.
R. E. Lombard.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4080, 1986. 34 p, 19 fig, 12 ref.

Descriptors: *Channel erosion, *Volcanoes, *Channel morphology, *Mount St. Helens, *Washington, Mudflows, Streams, Sediment transport, Sediment erosion, Flood control, Flood protection, Flood hazards, Toutle River, Cowlitz River.

The volcanic eruption of Mount St. Helens on May 18, 1980, triggered mudflows that deposited upwards of 15 ft of sediment in the channels of the lower Toutle and Cowlitz Rivers. The major population areas along the lower Cowlitz River (Kelso, Longview,Lexington, and Castle Rock) were not flooded, but the channel capacity of the river was seriously reduced and the potential for unusually high flood elevations from fall and winter storms was an obvious concern. The U.S. Army Corps of Engineers began dredging operations in June 1980 to alleviate the flood hazard. Surveys to monitor the effect of changes to the channel and flood plains that resulted from dredging and additional sediment inflow from the upper Toutle River basin were started in June 1980 and continued until May 11, 1981, when dredging operations on the Cowlitz River had been completed. (USGS)
W88-03327

MEASUREMENTS OF SCOUR-DEPTH NEAR BRIDGE PIERS,
Geological Survey, Minneapolis, MN. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03337

HYDRAULIC GEOMETRY AND STREAMFLOW OF CHANNELS IN THE PICEANCE BASIN, RIO BLANCO AND GARFIELD COUNTIES, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
J. G. Elliot, and K. D. Cartier.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4118, 1986. 28 p, 9 fig, 4 tab, 25 ref.

Descriptors: *Streamflow, *Channel morphology, *Hydraulic geometry, *Multiple-regression analysis, *Colorado, Basin characteristics, Streamflow forecasting, Piceance basin.

The influence of streamflow and basin characteristics on channel geometry was investigated at 18 perennial and ephemeral stream reaches in the Piceance basin of northwestern Colorado. Results of stepwise multiple regression analyses indicated that the variabilities of mean bankfull depth (D) and bankfull cross-sectional flow area (Af) were predominantly a function of bankfull discharge (QB), and that most of the variability in channel slopes (S) could be explained by drainage area (DA). None of the independent variables selected for the study could account for a large part of the variability in bankfull channel width (W). (USGS)
W88-03338

EFFECT OF URBANIZATION ON STREAMFLOW, SEDIMENT LOADS, AND CHANNEL MORPHOLOGY IN PHEASANT BRANCH BASIN NEAR MIDDLETON, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03357

SEDIMENT DISCHARGE IN THE COLORADO RIVER NEAR DE BEQUE, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
D. L. Butler.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4266, 1986. 30 p, 10 fig, 8 tab, 7 ref.

Descriptors: *Sediment discharge, *Silting, *Suspended sediment, *Bed load, *Reservoir deposition, *Colorado River, Streamflow, Sedimentation rate, De Beque, Una, Grand Junction, Colorado.

A study was conducted to determine annual-sediment discharge at the site of a proposed reservoir on the Colorado River at Una, located 3 miles upstream from De Beque, Colorado. Eleven suspended sediment samples were collected during 1984 at the De Beque bridge. These data were combined with suspended sediment data collected for the Colorado River at two nearby streamflow gaging stations to define relations between suspended-sediment discharge and stream discharge. Best results were obtained when the data were separated into two periods, March through Octo-

ber, and November through February. The data for March through October were separated into two periods: (1) Rising stream-stage period, which includes data collected prior to the data of the annual peak-stream discharge, and (2) falling stream-stage period, which includes data collected after the date of the annual peak-stream discharge. Nine bedload samples were collected during 1984 to determine the contribution of bedload sediment discharge to total sediment discharge. Bedload accounted for < 2% of total sediment discharge. The best relations describing bedload sediment discharge were obtained when the bedload data were separated into two periods: (1) Data collected prior to the date of the annual peak-stream discharge, and (2) data collected after the date of the annual peak-stream discharge. Mean annual sediment discharge in the Colorado River at the proposed Una reservoir site was estimated to be 1,065,000 tons/year for October 1966 through September 1984. Water storage capacity of the proposed reservoir would decrease about 30% after 100 years at this sediment discharge rate. (USGS)
W88-03359

MAGNITUDE AND FREQUENCY OF DEBRIS FLOWS, AND AREAS OF HAZARD ON MOUNT SHASTA, NORTHERN CALIFORNIA,
Geological Survey, Reston, VA. Water Resources Div.
W. R. Osterkamp, C. R. Hupp, and J. C. Blodgett.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-425, 1985. 35 p, 8 fig, 2 tab, 23 ref.

Descriptors: *Debris flows, *California, *Volcanoes, *Sediment transport, Pyroclastic flows, Hazards, Mount Shasta, Cascade Range.

Debris flows on Mount Shasta, northern California, have occurred frequently during the late Holocene in response to rapid runoff from melting snow and ice. Glacial-meltwater streams that deeply incise unstable pyroclastic and related flow deposits typically from debris flows when high discharge rates cause slope failures within steep-walled gorges. The landslide material either adsorbs streamflow quickly and becomes a slurry or it briefly dams the stream and converts to a debris flow as breaching occurs. All glacial-meltwater streams on Mount Shasta have been repeated debris-flow activity during the last 500 years. During this period, large-magnitude, potentially destructive flows on Mount Shasta have occurred at a rate of four per century, but smaller flows contained by stream channels may be 10 to 20 times more numerous. The smaller debris flows on Mount Shasta pose little hazard to human life or property, whereas larger, out-of-channel flows could cause minor damage. Only the City of McCloud and inhabited areas on the Whitney-Bolam fan appear to be threatened by possible debris-flow activity. None of the streams lacking glacial meltwater have had significant debris-flow activity during late Holocene time. Sediment yields from upper fan areas of Mount Shasta are very high, but most of the sediment, moved by debris flows from upper slopes is redeposited on lower fan areas, locally causing extensive and rapid aggradation of the fan surface. Little sediment enters a through-flowing stream network. Correspondingly high denudation rates in the sediment source areas for debris flows (the deep gorges) suggest that a high frequency of debris flows may be unique in recent centuries. (USGS)
W88-03370

PROCEEDINGS OF THE ADVANCED SEMINAR ON SEDIMENTATION, AUGUST 15-19, 1983, DENVER, COLORADO,
Geological Survey, Reston, VA. Water Resources Div.
G. D. Glysson.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-98, 1985. 69 p, 13 fig, 6 tab, 38 ref.

Descriptors: *Sedimentation, *Sediment transport, Channel morphology, Bedload, Coal mining, Erosion, Modeling, Instrumentation, Debris flow, Sediment chemistry.

On August 15-19, 1983, the U.S. Geological Survey's Water Resources Division sponsored an advanced seminar on sedimentation at the National Training Center in Lakewood, Colorado. Topics discussed were modeling, mud, and debris flows, transport, sediment chemistry, channel morphology, instrumentation, and bed load. This circular presents summaries of 28 presentations. (USGS)
W88-03383

SEDIMENT DISCHARGE DATA FOR THE LOWER REACH OF CAMPBELL CREEK, ANCHORAGE, ALASKA: MAY TO OCTOBER 1986,
Geological Survey, Anchorage, AK. Water Resources Div.
S. W. Lipscomb.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-101, 1987. 8 p, 3 fig, 3 tab, 5 ref.

Descriptors: *Sediment discharge, *Urban runoff, *Alaska, *Anchorage, Bridge design, Suspended sediment.

Streamflow and suspended sediment data were collected at two sites in Anchorage, Alaska, one upstream and one downstream from the proposed bridge construction site. Immediately downstream from the study reach, the creek enters Campbell Lake, an artificial impoundment in which sedimentation is becoming of concern to recreational users and lakeside residents. (USGS)
W88-03388

CHANNEL GEOMETRY AND HYDROLOGIC DATA FOR SIX ERUPTION-AFFECTED TRIBUTARIES OF THE LEWIS RIVER, MOUNT ST. HELENS, WASHINGTON, WATER YEARS 1983-84,
Geological Survey, Portland, OR. Water Resources Div.
H. A. Martinson, H. E. Hammond, W. W. Mast, and P. D. Mango.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-631, 1986. 161 p, 29 fig, 6 tab, 15 ref.

Descriptors: *Stream profiles, *Channel morphology, *Bank erosion, *Volcanoes, *Mount St. Helens, *Washington, Cross sections, Channel erosion, River basins, Mudflows.

The May 18, 1980, eruption of Mount St. Helens generated a lateral blast, lahars, and tephra deposits that altered stream channels in the Lewis River drainage basin. In order to assess potential flood hazards, monitor channel adjustments, and construct a sediment budget for disturbed drainages on the east and southeast flanks of the volcano, channel cross sections were monumented and surveyed on Pine Creek, Muddy River, and Smith Creek during September and October of 1980. Additional cross sections were monumented and surveyed on Swift Creek, Bean Creek, and Clearwater Creek during 1981. This network of channel cross sections has been resurveyed annually. Selected cross sections have been surveyed more frequently, following periods of higher flow. Longitudinal stream profiles of the low-water thalweg and (or) water surfaces were surveyed periodically for selected short reaches of channel. Corresponding map views for these reaches were constructed using the survey data and aerial photographs. This report presents plots of channel cross-section profiles, longitudinal stream profiles, and channel maps constructed from survey data collected during water years 1983-84. (USGS)
W88-03401

EVALUATION OF THE PRECIPITATION-RUNOFF MODELING SYSTEM, BEAVER CREEK, KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03422

SEDIMENT TRANSPORT ON STEEP SLOPES,
Clemson Univ., SC. Dept. of Civil Engineering.
N. M. Aziz.
Available from National Technical Information Service, Springfield, VA 22161, as PB87-190708/AS. Price codes: A05 in paper copy, A01 in microfiche. Water-Resources Investigations Report 84-4158, 1987. 34 p, 9 fig, 3 tab, 3 ref. Contract No. 14-08-0001-G-1043. Project No USGS G1043-04.

Descriptors: *Sediment transport, *Open channels, *Shallow water, *Stability analysis, Packed beds, Alluvial channels, Rapid flow, Steep slopes, Mathematical models.

The transport of non-cohesive sediment down steep slopes was studied both experimentally and theoretically. The experimental analysis included evaluation of the transport capacity of steep channels with simulated bed roughness and various grain sizes. The observations made during the experimental analysis on the mode of transport were utilized to develop a mathematical model. The mathematical model utilizes conservation of mass and conservation of momentum of the water and the sediment flow. To render the system of equations complete, a constitutive model, and in particular a Bingham model, for the sediment deformation was selected. The transport capacity of flows on steep slopes was considered to take place at the inception of flow instabilities in the upper flow regime. The comparison of the experimental and theoretical results indicates that the transport of sediment down steep slopes depends heavily on the flow rate, slope and grain size. The comparison also indicates that the moving sediment layer varies from 2 to 5 grain diameters in thickness. (Aziz-WRRI)
W88-03444

TRAP EFFICIENCY OF A SEDIMENT-CONTROL POND BELOW A BLOCK-CUT COAL MINE IN FAYETTE COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 4C.
W88-03451

DETERMINATION OF ROUGHNESS COEFFICIENTS FOR STREAMS IN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03463

MATHEMATICAL MODELING OF SEDIMENTATION EFFECTS ON WATER RESOURCES SYSTEMS,
Mississippi State Univ., Mississippi State. Center for Computational Hydroscience and Engineering.
S. S. Y. Wang.
Available from the National Technical Information Service, Springfield, VA 22161, as PB87-159455/AS. Price codes: A03 in paper copy, A01 in microfiche. Mississippi Water Resources Research Institute, Mississippi State. Technical Completion Report G1026-05, July 1986. 35 p, 23 fig, 94 ref. Contract No. 14-08-0001-G1026. Project No. USGS G1026-05.

Descriptors: *Sedimentation, *Distribution systems, *Mathematical models, *Path of pollutant, Sediment, Deposition.

Mathematical modeling was studied for use in investigating sedimentation in water resources systems. This study in important because soil sediment is not only the major water pollutant itself by weight and volume, but also carrier and storage agent of many other kinds of pollution. A numerical-empirical model has been developed for this purpose, which contains three basic elements: 1-d, 2-d, and 3-d models. To study either the basic characteristics of water resources systems or their response to external actions, one can use the 1-d element to predict the approximate behaviors of the overall system, and use neither 2-d or 3-d element to obtain properties of greater details or higher resolution at certain localities where 2-d or

3-d information of higher resolution is needed. This model not only has combined the state-of-the-art numerical methodology and the most reliable empirical knowledge but also is capable of producing optimum amounts of information at least cost. This cost-effective tool has the potential of being important in evaluating the effectiveness of engineering designs and remedial measures for maintaining the quality and supply of water resources, as well as in predicting the effects of management and planning policies on the water resources systems from short and long term points of view. (Wang-University of Mississippi)
W88-03492

2K. Chemical Processes

REDOX REACTIONS, MINERAL EQUILIBRIA, AND GROUND WATER QUALITY IN NEW ZEALAND AQUIFERS,
Department of Scientific and Industrial Research, Petone (New Zealand). Chemistry Div.
For primary bibliographic entry see Field 5B.
W88-02539

INTERACTION BETWEEN ORGANIC MOLECULES AND MINERAL SURFACES,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 5B.
W88-02550

CONTAMINANTS IN GROUNDWATER: CHEMICAL PROCESSES,
Waterloo Univ. (Ontario).
For primary bibliographic entry see Field 5B.
W88-02605

DETERMINATION OF ALKALI AND ALKALINE EARTH IONS IN RAIN WATER BY ION CHROMATOGRAPHY (BESTIMMUNG VON ALKALI- UND ERDALKALIIONEN IN REGENWASSERPROBEN MIT DER IONENCHROMATOGRAPHIE),
Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Anorganische Chemie und Kernchemie.
For primary bibliographic entry see Field 5A.
W88-02671

GAS-CHROMATOGRAPHIC ELEMENTAL ANALYSIS VIA DI(TRIFLUOROETHYL)DITHIOCARBAMATO-CHELATES: X. CAPILLARY GAS CHROMATOGRAPHY AT THE PG-LEVEL - DETERMINATION OF CO AND CR(VI) BESIDES CR(III) IN RIVER WATER,
Mainz Univ. (Germany, F.R.). Inst. fuer Anorganische Chemie und Analytische Chemie.
For primary bibliographic entry see Field 5A.
W88-02672

ION-CHROMATOGRAPHIC DETERMINATION OF CHLOROACETATE AND DICHLORACETATE IN PRECIPITATIONS (IONENCHROMATOGRAPHISCHE BESTIMMUNG VON CHLORACETAT UND DICHLORACETAT IN NIEDERSCHLAGSWASSERPROBEN),
Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Anorganische Chemie und Kernchemie.
For primary bibliographic entry see Field 5A.
W88-02673

DETERMINATION OF ORGANIC GROUP PARAMETERS (AOCL, AOBR, AOS) IN WATER BY MEANS OF ION-CHROMATOGRAPHIC DETECTION,
Gesamthochschule Paderborn (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W88-02674

SYNCHRONOUS FLUORESCENCE SPECTRA OF NATURAL WATERS: TRACING SOURCES OF DISSOLVED ORGANIC MATTER,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 7B.
W88-02676

NIGHT-TIME N2O5/NO3 CHEMISTRY AND NITRATE IN DEW WATER,
Ford Motor Co., Dearborn, MI. Research Staff.
For primary bibliographic entry see Field 5B.
W88-02682

RAIN CHEMISTRY AT A MIDCONTINENT SITE, U.S.A., 1980-1984,
Arkansas Univ., Fayetteville. Dept. of Geology.
For primary bibliographic entry see Field 2B.
W88-02683

SUPERSATURATION OF CARBONYL SULFIDE (OCS) IN RAIN WATERS,
Centre des Faibles Radioactives, Gif-sur-Yvette (France).
S. Belviso, N. Mihalopoulos, and B. C. Nguyen.
Atmospheric Environment ATENBP, Vol. 21, No. 6, p 1363-1367, June 1987. 4 fig, 1 tab, 20 ref.

Descriptors: *Supersaturation, *Carbonyl sulfide, *Rain chemistry, *Water chemistry, *Rainfall, Rainfall analysis, Acidity, Oxidation, Sulfur compounds.

Rain samples were collected during 9 months in 1985 at Gif-sur-Yvette, France, and their carbonyl sulfide content was measured. The majority of the 45 samples revealed the presence of significant OCS supersaturation. The average supersaturation index is 8.0 + or - 5.8 and the excess of dissolved OCS is correlated positively with the acid content of the rain water. The cause of the OCS enhancement is still unknown. This could probably be attributed to production processes within the rain drops, for which experimental evidences are not generally available. Several chemical mechanisms can be proposed to account for this phenomenon including the photo-oxidation of the organic material, the oxidation of some reduced sulfur gases and the hydrolysis of thiocyanate ions. Because of the OCS enhancement, rainfall in industrial areas may provide OCS into the atmosphere and could be a source of OCS rather than a sink. (Alexander-PTT)
W88-02684

VARIATION OF WET DEPOSITION CHEMISTRY IN SEQUOIA NATIONAL PARK, CALIFORNIA,
Sequoia and Kings Canyon National Parks, Three Rivers, CA.
For primary bibliographic entry see Field 5B.
W88-02685

TREATING UNCERTAINTY IN MODELS OF THE ATMOSPHERIC CHEMISTRY OF NITROGEN COMPOUNDS,
UKAEA Atomic Energy Research Establishment, Harwell (England). Modelling and Assessments Group.
R. G. Derwent.
Atmospheric Environment ATENBP, Vol. 21, No. 6, p 1445-1454, June 1987. 7 fig, 6 tab, 13 ref.

Descriptors: *Model studies, *Path of pollutants, *Acid rain, Rain chemistry, *Water chemistry, *Rainfall, *Nitrogen compounds, Transport, Deposition.

A highly simplified model of the long-range transport and deposition of nitric oxide, nitrogen dioxide, gaseous nitric acid and nitrate aerosol over NW Europe is presented. A 'constant drizzle' representation of wet removal of gaseous nitric acid and nitrate aerosol is developed in addition to the representation of dry deposition using appropriate deposition velocities. An analysis of the sensitivity of dry and wet deposition rates of oxidized nitrogen species at a remote, receptor site to the individual model parameters is described. This analysis is extended using latin hypercube sampling to an evaluation of the uncertainties in modelled dry and wet deposition and the contribution played by each model input parameter. Clearly, this method of analysis can contribute to a discussion of uncertainties and how attention from field studies and experimental work can best be directed to reducing present uncertainties and improve the quantification of the behavior of nitrogen in NW Europe. It is important conclusion of this work that the calculated dry deposition values are not significantly influenced by uncertainties in emission strengths because other parameters are much more uncertain. (Alexander-PTT)
W88-02687

ION-CHROMATOGRAPHIC TRACE ANALYSIS OF AMPEROMETRICALLY DETECTABLE ANIONS IN WATER (IONEN-CHROMATOGRAPHISCHE SPURENANALYSE AMPEROMETRISCH DETEKTIERBARER ANIONEN IN WASSERN),
Stuttgart Univ. (Germany, F.R.). Inst. fuer Lebensmittelchemie.
For primary bibliographic entry see Field 5A.
W88-02724

PRECONCENTRATION OF SILVER(I), GOLD(III) AND PALLADIUM(II) IN WATER SAMPLES WITH 2,2'-DIPYRIDYL-3-((4-AMINO-5-MERCAPTO)-1,2,4-TRIAZOLYL)HYDRAZONE SUPPORTED ON SILICA GEL,
Thessaloniki Univ., Salonika (Greece). Lab. of Analytical Chemistry.
For primary bibliographic entry see Field 5A.
W88-02725

GROUNDWATER GEOCHEMISTRY OF SHORT-TERM AQUIFER THERMAL ENERGY STORAGE TEST CYCLES,
Illinois State Water Survey Div., Champaign.
For primary bibliographic entry see Field 2F.
W88-02778

WATER ANALYSIS,
For primary bibliographic entry see Field 5A.
W88-02804

DETERMINATION OF ALKALI AND ALKALINE EARTH IONS IN RAIN WATER BY ION CHROMATOGRAPHY (BESTIMMUNG VON ALKALI- UND ERDALKALIIONEN IN REGENWASSERPROBEN MIT DER IONENCHROMATOGRAPHIE),
Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Anorganische Chemie und Kernchemie.
For primary bibliographic entry see Field 5A.
W88-02816

GAS-CHROMATOGRAPHIC ELEMENTAL ANALYSIS VIA DI(TRIFLUOROETHYL) DITHIOCARBAMATO CHELATES: X. CAPILLARY GAS CHROMATOGRAPHY AT THE PG-LEVEL - DETERMINATION OF CO AND CR(VI) BESIDES CR(III) IN RIVER WATER,
Mainz Univ. (Germany, F.R.). Inst. fuer Anorganische Chemie und Analytische Chemie.
For primary bibliographic entry see Field 5A.
W88-02817

ION-CHROMATOGRAPHIC DETERMINATION OF CHLOROACETATE AND DICHLORACETATE IN PRECIPITATION (IONENCHROMATOGRAPHISCHE BESTIMMUNG VON CHLOROACETAT UND DICHLOROACETAT IN NIEDERSCHLAGSWASSERPROBEN),
Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Anorganische Chemie und Kernchemie.
For primary bibliographic entry see Field 5A.
W88-02818

DETERMINATION OF ORGANIC GROUP PARAMETERS (AOCL, AOBR, AOS) IN WATER

BY MEANS OF ION-CHROMATOGRAPHIC DETECTION,
Gesamthochschule Paderborn (Germany, F.R.). Fachbereich 13 - Chemie und Chemietechnik.
For primary bibliographic entry see Field 5A.
W88-02819

ION AND TEMPERATURE DEPENDENCE OF ELECTRICAL CONDUCTANCE FOR NATURAL WATERS,
Minnesota Univ., Duluth. Dept. of Chemistry.
For primary bibliographic entry see Field 7B.
W88-02857

EXTRACTION AND RECOVERY OF POLYCYCLIC AROMATIC HYDROCARBONS FROM ENVIRONMENTAL SOLIDS USING SUPERCRITICAL FLUIDS,
North Dakota Univ., Grand Forks. Energy Research Center.
For primary bibliographic entry see Field 5A.
W88-02858

DETERMINATION OF VOLATILE PRIORITY POLLUTANTS IN WATER BY PURGE AND TRAP AND CAPILLARY COLUMN GAS CHROMATOGRAPHY/MASS SPECTROMETRY,
Acurex Corp., Mountain View, CA. Environmental Systems Div.
For primary bibliographic entry see Field 5A.
W88-02859

DETERMINATION OF ALKYLBENZENESULFONATE SURFACTANTS IN GROUNDWATER USING MACRORETICULAR RESINS AND CARBON-13 NUCLEAR MAGNETIC RESONANCE SPECTROMETRY,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 5A.
W88-02860

SELECTIVE PRECONCENTRATION OF IRON IN BEVERAGES AND WATER SAMPLES USING 2,4,6-TRI-2-PYRIDINYL-1,3,5-TRIAZINE-TETRAPHENYLBORATE-NAPHTHALENE ADSORBENT,
Indian Inst. of Tech., New Delhi. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W88-02861

DESIGN AND EVALUATION OF AN ELECTROCHEMICAL SENSOR FOR DETERMINATION OF DISSOLVED OXYGEN IN WATER,
Universidad Nacional de San Luis (Argentina). Facultad de Quimica, Bioquimica y Farmacia.
For primary bibliographic entry see Field 7B.
W88-02862

NEUTRON ACTIVATION AND ATOMIC ABSORPTION ANALYSIS OF ULVA LACTUCA AND GRACILARIA VERRUCOSA FROM THERMAIKOS GULF, GREECE,
Sofia Univ. (Bulgaria). Khimicheski Fakultet.
For primary bibliographic entry see Field 5A.
W88-02880

HYDROGEOCHEMICAL STUDY OF THE DRINKING WATER FROM THE KHAYBAR VILLAGE, SW SAUDI ARABIA,
King Saud Univ., Riyadh (Saudi Arabia).
For primary bibliographic entry see Field 2F.
W88-02883

COMPUTED SOLID PHASES LIMITING THE CONCENTRATION OF DISSOLVED CONSTITUENTS IN BASALT AQUIFERS OF THE COLUMBIA PLATEAU IN EASTERN WASHINGTON,
Battelle Pacific Northwest Labs., Richland, WA.
W. J. Deutsch, E. A. Jenne, and K. M. Krupka.
Available from the National Technical Information Service, Springfield, VA 22161, as DE82-021962, A04 in paper copy, A01 in microfiche. PNL-4089, August 1982. Geochemical Modeling and Nuclide/Rock/Groundwater Interaction Studies. 37 p, 10 fig, 2 tab, 61 ref, append. Contract No. DE-AC06-76RLO 1830.

Descriptors: *Water chemistry, *Aquifers, *Radioactive wastes, *Dissolved solids, *Solute transport, Groundwater pollution, Path of pollutants, Calcite, Calcium, Minerals, Groundwater movement, Clay minerals, Silica, Fate of pollutants, Water pollution sources, Sorption, Geochemistry, Washington.

A speciation-solubility geochemical model, WATEQ2, was used to analyze geographically-diverse, groundwater samples from the aquifers of the Columbia Plateau basalts in eastern Washington. The groundwater samples compute to be at equilibrium with calcite, which provides both a solubility control for dissolved calcium and a pH buffer. Amorphic ferric hydroxide, Fe(OH3(A)), is at saturation or modestly oversaturated in the few water samples with measured redox potentials. Most of the groundwater samples compute to be at equilibrium with amorphic silica (glass) and wairakite, a zeolite, and are saturated to oversaturated with respect to allophane, an amorphic aluminosilicate. The water samples are saturated to undersaturated with halloysite, a clay, and are variably oversaturated with regard to other secondary clay minerals. Equilibrium between the groundwater and amorphic silica presumably results from the dissolution of the glassy matrix of the basalt. The oversaturation of the clay minerals other than halloysite indicates that their rate of formation lags the dissolution rate of the basaltic glass. The modeling results indicate that metastable amorphic solids limit the concentration of dissolved silicon and suggest the same possibility for aluminum and iron. The results also suggest that the processes of dissolution of basaltic glass and formation of metastable secondary minerals are continuing even though the basalts are of Miocene age, and presumably have undergone a long history of contact with groundwaters. The computed solubility relations are found to agree with the known assemblages of alteration minerals in the basalt fractures and vesicles, if account is taken of both the difficulty of identifying amorphic phases and the slow rate of formation of clay minerals at low temperatures. (Author's abstract)
W88-02894

STREAMFLOW AND SPECIFIC-CONDUCTANCE DATA FOR BEAR CREEK, AUGUST 13, 1985, THE OAK RIDGE RESERVATION, TENNESSEE,
Geological Survey, Knoxville, TN. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-02954

GROUND-WATER QUALITY DATA FROM THE NORTHERN MISSISSIPPI EMBAYMENT -- ARKANSAS, MISSOURI, KENTUCKY, TENNESSEE AND MISSISSIPPI,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-02955

PROGRESS REPORT ON THE GEOCHEMISTRY OF THE SULFUR CYCLE IN NORTHERN GREAT PLAINS COAL MINES,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-02975

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND RANGE PROVINCE, NORTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-02983

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER, BASIN AND RANGE PROVINCE, TEXAS,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-02984

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER BASIN AND RANGE PROVINCE, SOUTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-02985

MAPS SHOWING DISTRIBUTION OF DISSOLVED SOLIDS AND DOMINANT CHEMICAL TYPE IN GROUND WATER BASIN AND RANGE PROVINCE, IDAHO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-02986

PHRQINPT-AN INTERACTIVE COMPUTER PROGRAM FOR CONSTRUCTING INPUT DATA SETS TO THE GEOCHEMICAL SIMULATION PROGRAM PHREEQE,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03003

RECONNAISSANCE OF THE QUALITY OF SURFACE WATER IN THE SAN RAFAEL RIVER BASIN, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
J. C. Mundorff, and K. R. Thompson.
Utah Department of Natural Resources, Salt Lake City, Technical Publication No. 72, 1982. 53 p, 13 fig, 7 tab, 10 ref.

Descriptors: *Water quality, *Surface water, *Fluvial sediment, *Sediment yield, *Utah, Chemical constituents, Chemical analysis, Surface geology, Reconnaissance studies, Upper Colorado River Basin, San Rafael River.

This water-quality reconnaissance of the San Rafael River basin encompassed an area of about 2,300 square miles. Data were obtained by the U.S. Geological Survey one or more times at 116 sites from June 1977-September 1978. The San Rafael River, which is formed by the confluence of Huntington, Cottonwood Creeks, and Ferron Creek, 0.33 mile downstream from the confluence has no perennial tributaries. Except during short periods of thunderstorm runoff in tributaries, the flow is a composite of flow from Huntington, Cottonwood, and Ferron Creeks. The greatest change in chemical characteristics of water in the San Rafael River basin occurs in Huntington, Cottonwood and Ferron Creek across a belt of land 10 to 15 miles wide where nearly all the intensive irrigation occurs. Dissolved-solids concentrations at the diversions are generally less than 500 mg/L and at the mouths of Huntington, Cottonwood, and Ferron Creeks are generally greater than 2,000 mg/L. The concentrations of trace elements, with the exception of strontium, were low; strontium concentrations exceeded 1,500 mg/L at seven sites. The few data on total coliform, fecal coliform, and fecal streptococci bacteria indicate a general absence of major biologic pollution in the basin. (USGS)
W88-03005

WATER-QUALITY VARIATIONS IN ANTELOPE CREEK AND DEAD MAN'S RUN, LINCOLN, NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.

For primary bibliographic entry see Field 5B.
W88-03021

QUALITY OF GROUND WATER IN SOUTHEASTERN-SOUTH CENTRAL WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03027

GROUND-WATER CONTRIBUTION TO THE SALINITY OF THE UPPER COLORADO RIVER BASIN,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03044

INTERLABORATORY COMPARABILITIES, BIAS, AND PRECISION FOR FOUR LABORATORIES MEASURING CONSTITUENTS IN PRECIPITATION, NOVEMBER 1982-AUGUST 1983,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03046

WATER QUALITY IN THE BLUE CREEK ARM OF LAKE EUFAULA AND BLUE CREEK, OKLAHOMA, MARCH-OCTOBER 1978,
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03050

GROUND-WATER QUALITY IN THE SANTA YNEZ VALLEY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03052

SELECTED WATER-QUALITY DATA FOR THE SAN JOAQUIN RIVER AND ITS TRIBUTARIES, CALIFORNIA, JUNE TO SEPTEMBER 1985,
Geological Survey, Sacramento, CA. Water Resources Div.
R. J. Gilliom.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-74, 1986. 12 p, 1 fig, 2 tab, 3 ref.

Descriptors: *Water quality, *San Joaquin River, *California, Boron, Molybdenum, Selenium, Streamflow, Dissolved solids.

Streamflow, specific conductance, and concentrations of dissolved solids, boron, molybdenum, and selenium were measured at 11 sites on the San Joaquin River and its tributaries approximately twice per month during June to September 1985. Streamflows were lowest in the San Joaquin River near Stevinson (median 43 cu ft sq /sec) and in Mud Slough (median 74.7 cu ft sq). The flow of the San Joaquin River increased downstream to Vernalis (median 2,460 cu ft sq); most flows are from the Merced (median 221.5 cu ft sq), Tuolumne (median 201 cu ft sq), and Stanislaus (median 1,390 cu ft sq) Rivers, which enter the San Joaquin River from the east. The Stanislaus River had the lowest median concentrations of dissolved solids (59 milligrams per liter), dissolved boron (10 micrograms per liter), and dissolved molybdenum (less than 1 microgram per liter). Dissolved selenium was lowest in the Stanislaus, Tuolumne, and Merced Rivers, and the San Joaquin River near Stevinson, all of which had concentrations that were not detectable at the level of 1 microgram per liter, except for one detection of dissolved selenium of 1 microgram per liter in the Tuolumne River. Mud Slough had the highest median concentrations of dissolved solids (1,425 milligrams per liter), dissolved boron (2,850 micrograms per liter), and dissolved selenium (21 micrograms per liter). The highest dissolved molybdenum concentrations were in Mud Slough (8 micrograms per liter) and the San Joaquin River at Freemont Ford (8 micrograms per liter). (USGS)
W88-03097

MARYLAND SPRINGS--THEIR THERMAL AND CHEMICAL CHARACTER,
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03102

STUDY AND INTERPRETATION OF THE CHEMICAL CHARACTERISTICS OF NATURAL WATER--3RD EDITION,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. D. Hem.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Supply Paper 2254, 1985. 264 p, 54 fig, 33 tab, 600 ref.

Descriptors: *Geochemistry, *Water chemistry, *Chemical reactions, Chemical analysis, Chemical thermodynamics, Chemical processes, Water-quality evaluation.

Principles of chemistry, geology, and hydrology and naturally occurring or man-influenced processes operating at and near the surface of the Earth produce natural water compositions that range from nearly solute-free rain to salt-saturated underground brines. Ways in which these factors influence the occurrence of more than 60 major and minor constituents and properties of natural water are discussed and illustrated by analytical data for more than 80 water samples. Mathematical and graphical techniques useful for pointing out correlations among chemical and environmental factors are described and applied to these data. Evaluation of water resources for various uses and maintaining satisfactory quality after development also are aided by the application of these techniques. This book is a revised and updated version of a 1970 publication with the same title. (USGS)
W88-03112

AQUEOUS GEOCHEMISTRY OF THE BRADYS HOT SPRINGS GEOTHERMAL AREA, CHURCHILL COUNTY, NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.
A. H. Welch, and A. M. Preissler.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. Supt Doc, USGPO, Wash, DC 20402. In: USGS Water-Supply Paper 2290, 1986. p 17-36, 7 fig, 3 tab, 37 ref.

Descriptors: *Geochemistry, *Geothermal studies, *Nevada, Geohydrology, Hydrology, Isotope studies, Bradys Hot Springs.

The aqueous geochemistry of the Bradys Hot Springs geothermal system has been examined to evaluate the source of recharge to the system, the thermal aquifer temperature, and the geochemical controls on the major and selected minor constituents in the thermal water. The Bradys Hot Springs geothermal area is associated with a typical mountain-bounding fault in the Basin and Range province. The area is the discharge part of a thermal system that currently (1985) supplies heat for a commercial food-dehydration plant. The hottest water sampled at Bradys Hot Springs contains about 2,600 milligrams per liter of dissolved solids dominated by sodium, chloride, and sulfate. Chemical geothermometer data indicate thermal-aquifer temperatures ranging from 137 to 184 C, although a measured down-hole temperature of 212 C has been reported. Local meteoric water that has been concentrated by evaporation is the likely source of recharge to the thermal system. The primary controls on the dissolved-solids content of the thermal water (heated, deeply circulating groundwater) apparently are evaporative concentration before recharge to the thermal aquifer and an increase in silica during passage through the thermal aquifer. Evaporative concentration and mineral solubility appear to be the primary controls on the minor constituents. Bromide is controlled primarily by evaporative concentration. Barium, fluoride, lead, and manganese concentrations may be controlled by mineral solubility. Lithium and, to a lesser extent, boron and strontium are more concentrated in the thermal water than in the local nonthermal water with the same chloride concentrations; these elements thus may be useful indicators of thermal water in the vicinity of Bradys Hot Springs when used in conjunction with chloride data. (USGS)
W88-03114

EVALUATION OF A SUGGESTED SEQUENCE FOR THE CHEMICAL EXTRACTION OF SOLUBLE AMORPHOUS PHASES FROM CLAYS,
Geological Survey, Reston, VA. Water Resources Div.
S. L. Rettig, and B. F. Jones.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. Supt Doc, USGPO, Wash, DC 20402. In: USGS Water-Supply Paper 2290, 1986. p 127-138, 8 fig, 3 tab, 17 ref.

Descriptors: *Mineral-water interactions, *Clays, *Ion exchange, *Nevada, Extraction, Amorphous material, Phase separation, Sediment, Nevada Test Site, Fairbanks Butte, Amargosa Desert, Lake Albert, Lang Valley, Great Salt Lake, Potomac River.

Because the separation of phases is important for the interpretation of sediment-water interaction, the efficacy of a sequential treatment for the chemical extraction of soluble amorphous phases from clays was evaluated. Treatment consisted of extraction by 0.1M sodium pyrophosphate, followed by 1M hydroxylamine hydrochloride and either sodium acetate or acetic acid, and finally by 0.2M ammonium oxalate. Both the dissolved material and remaining fine particulates were chemically analyzed after each step. Seven samples were chosen to represent a broad spectrum of ultrafine clays from environments of aqueous deposition. Significant amounts of crystalline clay mineral components were removed at each step of the extraction sequence. Some changes can be attributed to ion exchange or loss of intergrade complexes, but dissolution of clay crystallites with or without reprecipitation of amorphous aluminosilicate must also occur. (USGS)
W88-03123

EFFECTS OF LIQUID ORGANIC CONTAMINANTS ON GEOTECHNICAL PROPERTIES OF CLAY SOILS,
New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5C.
W88-03254

PREDICTED VS. MEASURED AIR EMISSIONS OF VOLATILE ORGANICS FROM A SIMULATED HAZARDOUS LIQUID WASTE LAGOON,
Chemical Industry Inst. of Toxicology, Research Triangle Park, NC.
For primary bibliographic entry see Field 5B.
W88-03263

ARSENIC DATA FOR STREAMS IN THE UPPER MISSOURI RIVER BASIN, MONTANA AND WYOMING,
Geological Survey, Helena, MT. Water Resources Div.
J. R. Knapton, and A. A. Horpestad.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-124, 1987. 25 p, 5 fig, 4 tab, 7 ref.

Descriptors: *Arsenic, *Water quality, *Montana, *Missouri River, *Water pollution sources, *Geothermal water, Monitoring, Wyoming, Streamflow.

Although large concentrations of arsenic originating from geothermal sources within Yellowstone National Park have been known to be present in the Madison River for many years, systematic

monitoring throughout the upper Missouri River basin had not been done. Therefore, a monitoring network consisting of 24 stations was established for the purpose of measuring arsenic concentrations and determining arsenic discharge. Included were 5 sites on mainstems of the Madison and Missouri Rivers and 19 sites on major and some minor tributaries from Yellowstone National Park to Canyon Ferry Lake. Fifteen of the 24 stations were sampled 12 times from November 1985 to October 1986. The remaining stations were sampled twice during the year, at high flow and at low flow. Total recoverable arsenic discharge (loading) in pounds per day was calculated for each sample by multiplying total recoverable arsenic concentration by water discharge (obtained at time of sample collection) and a conversion factor. This report presents data resulting from the monitoring program. (USGS)
W88-03304

REAERATION COEFFICIENTS OF SIX STREAMS IN NEW YORK--A COMPARISON OF RESULTS OBTAINED BY A HYDROCARBON-GAS TRACER METHOD WITH THOSE OBTAINED BY RADIOACTIVE-TRACERS AND PREDICTIVE EQUATIONS,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03341

WATER QUALITY OF STREAMS AND SPRINGS, GREEN RIVER BASIN--WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
L. L. DeLong.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 82-4008, 1986. 36 p, 19 fig, 6 tab, 27 ref.

Descriptors: *Salinity, *Trace elements, *Water quality, *Wyoming, *Surface waters, *Groundwater, Phosphorus, Green River Basin, Lognormal distribution, Detection limits.

Data concerning salinity, phosphorus, and trace elements in streams and springs within the Green River Basin in Wyoming are summarized. Relative contributions of salinity are shown through estimates of annual loads and average concentrations at 11 water quality measurements sites for the 1970-77 water years. A hypothetical diversion of 20 cu ft/sec from the Big Sandy River was found to lower dissolved solids concentration in the Green River at Green River, Wyoming. This effect was greatest during the winter months, lowering dissolved solids concentration as much as 13%. Decrease in dissolved solids concentrations during the remainder of the year was generally less than 2%. Unlike the dilution effect that overland runoff has on perennial streams, runoff in ephemeral and intermittent streams within the basin was found to be enriched by the flushing of salts from normally dry channels and basin surfaces. Relative concentrations of sodium and sulfate in streams within the basin appear to be controlled by solubility. A downstream trend of increasing relative concentrations of sodium, sulfate, or both with increasing dissolved solids concentration was evident in all streams sampled. Estimates of total phosphorus concentration at water quality measurement sites indicate that phosphorus is removed from the Green River water as it passes through Fontenelle and Flaming Gorge Reservoirs. Total phosphorus concentration at some stream sites is directly or inversely related to streamflow, but at most sites a simple relation between concentration and streamflow is not discernable. (USGS)
W88-03353

ALTITUDE OF THE TOP OF SALINE GROUND WATER IN THE SOUTHEASTERN COASTAL PLAIN,
Geological Survey, Atlanta, GA. Water Resources Div.
R. W. Lee, A. K. Sparkes, and R. A. Barker.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4109, 1986. 1 sheet (map), 2 fig, 10 ref.

Descriptors: *Saline water, *Saline-freshwater interface, *Southeastern Coastal plain, *Groundwater quality, *Maps, Saltwater, Water pollution sources, Southeast U.S.

A map prepared by the U.S. Geological Survey shows the approximate distribution of saline water (greater than 10,000 mg/L as NaCl) in the Southeastern Coastal Plain. The primary distribution of saline water is in Cretaceous sediments and may be characterized as an extensive body of fluid whose upper surface generally slopes upward from inland toward coastal areas. Some freshwater appears to occupy parts of the deeper water-bearing zones in Georgia. A small amount of saline water appears to occupy a narrow upper zone of limited extent in lower Tertiary sediments in Georgia and parts of South Carolina. The freshwater-saline water interface for the lower zone lies offshore, east of the South Carolina coast. Consequently, the saline water distribution is inferred offshore. (USGS)
W88-03361

CHEMICAL COMPOSITION OF GROUND WATER IN THE YUCCA MOUNTAIN AREA, NEVADA--AN UPDATE,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03373

CLAY SIZED FRACTION AND POWERED WHOLE ROCK X-RAY ANALYSIS FROM ALLUVIAL BASIN DEPOSITS IN CENTRAL AND SOUTHERN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
S. K. Anderholm.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-173, 1985. 18 p, 1 tab, 5 ref.

Descriptors: *Alluvial sediments, *Geochemistry, *Groundwater chemistry, *New Mexico, Clay, Fine grained sediments, Lithology, Southwest alluvial basin, Rio Grande rift.

As part of the study of the water quality and geochemistry of Southwest Alluvial Basins (SWAB) in parts of Colorado, New Mexico, and Texas, which is a Regional Aquifer-System Analysis (RASA) program, whole rock x-ray analysis and clay-size fraction mineralogy (x-ray) analysis of selected samples from alluvial basin deposits were done to investigate the types of minerals and clay types present in the aquifers. This was done to determine the plausible minerals and clay types in the aquifers that may be reacting with groundwater and affecting the water quality. The purpose of this report is only to present the whole rock x-ray and clay-fraction mineralogy data. Nineteen surface samples or samples from outcrop of Tertiary and Quaternary alluvial basin deposits in the central and southern Rio Grande rift were collected and analyzed. The analysis of the samples consisted of grain size analysis, and clay-size fraction mineralogy and semiquantitative analysis of the relative abundance of different clay mineral groups present. (USGS)
W88-03382

HYDROLOGIC, LITHOLOGIC, AND CHEMICAL DATA FOR SEDIMENTS AT TWO SITES IN THE SHALLOW ALLUVIAL AQUIFER NEAR FALLON, NEVADA, 1984-85,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03392

OCCURRENCE OF DISSOLVED SODIUM IN GROUND-WATERS OF BASALTS UNDERLYING THE COLUMBIA PLATEAU, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03428

VARIABILITY IN BASE STREAMFLOW AND WATER QUALITY OF STREAMS AND SPRINGS IN OTTER AND ROSEBUD CREEK BASINS, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03440

GROUND-WATER QUALITY AND GEOCHEMISTRY OF AQUIFERS ASSOCIATED WITH COAL IN THE ALLEGHENY AND MONONGAHELA FORMATIONS IN SOUTHEASTERN OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
A. C. Razem, and A. C. Sedam.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4034, 1985. 39 p, 10 fig, 4 tab, 17 ref.

Descriptors: *Groundwater quality, *Geochemistry, *Ohio, Groundwater, Aquifers, Coal, Statistical analysis, Coal mining, Allegheny Formation, Monongahela Formation, Discriminant function analysis.

Groundwater from aquifers associated with coal beds in the Allegheny and Monongahela Formations in southeastern Ohio is predominantly a calcium magnesium bicarbonate type. Sodium bicarbonate type water occurs less frequently. Sodium chloride and calcium sulfate types also are present in isolated areas. The water is predominantly very hard, and has a median dissolved solids concentration of 436 mg/L. Geochemical processes that produce iron characterize the Allegheny Formation, whereas the Monongahela Formation is characterized by processes that produce sulfate. The occurrence of either sulfate of iron is attributed to the kinetic mechanism operating during the oxidation of pyrite. The position along the sulfide or ferrous-iron oxidation pathways controls the reaction products of pyrite found in solution, and the formation of either sulfate or iron. The availability and rate of diffusion of oxygen in the formations exerts control on the water quality. (USGS)
W88-03447

CONTROLS ON GROUND-WATER CHEMISTRY IN THE HORSE HEAVEN HILLS, SOUTH-CENTRAL WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
W. C. Steinkampf, G. C. Bortleson, and F. A. Packard.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4048, 1985. 26 p, 12 fig, 1 tab, 12 ref.

Descriptors: *Groundwater quality, *Geochemistry, *Water chemistry, *Washington, Basalts, Chemical reactions, Groundwater, Sodium, Subsurface water, Water quality, Zeolites, Columbia Plateau, Columbia River basalt Group, Horse Heaven Hills.

Miocene basaltic aquifers are the source of domestic and municipal water, and about 20,000 acre-feet of irrigation water annually, in the Horse Heaven Hills in south-central Washington State. Groundwater chemical variations derive from the hydraulic characteristics is of the geohydrologic system, from groundwater basalt reactions, and from irrigation. Some dissolved species concentrations increase with residence time; others decrease. Recharge area groundwaters are calcium magnesium sodium bicarbonate waters with sodium-adsorption ratios (SAR's) less than 1.0. They evolve to sodium potassium bicarbonate waters with SAR's as high as 17. Glassy and cryptocrystalline phases of the basalt are the main sources of dissolved sodium. They dissolve by silicate hydrolysis in carbon dioxide charged waters that recharge the aquifer system. Dissolved silicon, iron, and aluminum concentrations are controlled by the solubilities of amorphous secondary alteration products, which order to silica phases, oxyhydroxides, and smectite. Carbonate mineral precipitation is induced by increasing pH from the hydrolysis reaction. Sodium

and potassium concentrations increase until clinoptilolite saturation is reached and precipitation begins. Deviations from the general variation patterns are due to localized geologic structures which distort the groundwater flow system, and to the irrigation use of Columbia River water. (USGS)
W88-03449

HYDROLOGY OF AREA 54, NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03452

GEOCHEMICAL CONTROLS ON DISSOLVED SODIUM IN BASALT AQUIFERS OF THE COLUMBIA PLATEAU, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
P. P. Hearn, W. C. Steinkampf, G. C. Bortleson, and B. W. Drost.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4304, 1985. 38 p, 17 fig, 2 tab, 30 ref.

Descriptors: *Geochemistry, *Geohydrology, *Groundwater, *Washington, Basalts, Chemical precipitation, Chemical reactions, Clay minerals, Equilibrium, Hydrolysis, Silicates, Sodium, Solutes, Basalt aquifers, Columbia Plateau, Columbia River Basalt, Groundwater chemistry, Secondary minerals.

Miocene basaltic aquifers of the Columbia Plateau are the principal source of water for agricultural, domestic, and municipal use in Washington State. Irrigation with groundwaters with relatively high sodium concentrations has been cause for concern in recent years, because of the tendency of such waters to reduce soil permeability. Chemical reactions involving groundwater and the basalts are the primary mechanisms responsible for the input of sodium to groundwater in the plateau. This conclusion is supported by the sequence of secondary alteration products found and by progressive changes in groundwater chemistry with depth and position along regional flow paths. Upgradient and shallow groundwaters have low sodium concentrations and sodium-adsorption ratios (SAR's), and are predominantly calcium sodium bicarbonate waters. Groundwaters from deeper and downgradient locations have higher sodium concentrations and SAR's and are predominantly sodium bicarbonate water. Volcanic glass and cryptocrystalline matrix are the major sources of groundwater sodium, and are dissolved by a combination of silicate hydrolysis and dissolution by carbonic acid. Magnesium, iron, and calcium are removed from solution by the formation of an iron magnesium smectite, calcite, and amorphous iron oxyhydroxide. The addition of sodium, silicon, and potassium by dissolution of basalt exceeds their removal by the precipitation of secondary minerals, and their concentrations increase in the initial stages of this process. In later stages, these continued increases produce a water saturated with clinoptilolite and silica phases, and these begin to precipitate. While the timing of these processes is unclear, the mineralogy of secondary alteration and estimated cooling rates of the basalt flows suggest that observed alteration products formed primarily at low temperature, under conditions similar to those existing at the present time. (USGS)
W88-03460

CHEMISTRY AND APPARENT QUALITY OF SURFACE WATER AND GROUND-WATER ASSOCIATED WITH COAL BASINS,
Arkansas Univ., Fayetteville. Water Resources Research Center.
R. B. Stroud, J. L. Spellman, R. R. Potts, and A. J. Oakley.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-170511/AS. Price codes: A05 in paper copy, A01 in microfiche. AWRRC No. 113, September 1985. 87 p, 16 fig, 1 plate. Contract No. 14-08-0001-G893. Project No. USGS G893-24.

Descriptors: *Surface water, *Coal mining, *Arkansas, Groundwater, Chemical analysis, Atomic adsorption analysis, Water quality, Water chemistry.

Preliminary investigations were conducted on the chemistry and quality of surface and groundwater associated with 12 coal-bearing sub-basins in the Arkansas Valley coal field. The coal field is approximately 60 miles long and 33 miles wide but only in 12 areas coal is thick enough and has proper quality to be termed commercial. Both surface and underground sample sites were established in each of the sub-basins with some minor variations in four areas where not all types of sites could be located. Water was collected from 19 surface points and 19 underground points in the established areas. Both field and laboratory analyses were made and elemental contents are reported. The chemistry and water quality suggest that all water is suitable for agricultural and industrial uses. To obtain potable water, treatment must reduce calcium, magnesium, sodium sulfate and iron. The mineral content of the water is due to its contact with coal-bearing zones and reflects the mineral content of the coal. It is recommended that additional studies be undertaken on the petrography and geochemistry of the coal, overburden and underburden. Also, it is recommended that at least one detailed study be made of one of the coal subbasins with regard to hydrogeology. This report is an important first step in determining the character and quality of Arkansas coal. (Stroud-WRRC-University of Arkansas, Fayetteville)
W88-03486

2L. Estuaries

CREATION OF FISHERY HABITAT IN ESTUARIES,
National Marine Fisheries Service, Galveston, TX. Galveston Lab.
T. J. Minello, R. J. Zimmerman, and E. F. Klima.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 106-120, 4 fig, 19 ref.

Descriptors: *Dredging, *Estuarine fisheries, *Salt marshes, *Wildlife habitat, *Spoil disposal, *Waste disposal, *Sediment disposal, *Marsh plants, Estuaries, Ecological effects, Marsh management, Shrimp, Crabs, Trout, Population density, Environmental effects.

The importance of estuaries for U. S. commercial and recreational fisheries, combined with accelerating habitat loss in these estuaries, requires action on the part of managing agencies in order to avert major declines in fishery stocks. Studies on abundance patterns of organisms in estuaries are useful in determining the importance of habitats under the assumption that organisms can and will select habitats that are optimal for growth and survival. Comparisons of paired samples show that juveniles of fishery organisms, including brown shrimp, blue crabs, and spotted sea trout, select intertidal Spartina alterniflora habitat over adjacent nonvegetated bottom. Plant structure provided by a S. alterniflora marsh also provides brown shrimp with protection from some fish predators. Disturbed sediments of dredged material in transplanted marshes have more available nutrients than natural sediments. The presence of higher nutrient levels may cause eutrophic conditions unattractive to fisheries. Transplanted marshes also displayed areas of dieback and low abundances of macrofauna. Research in Galveston Bay, Texas, is being designed to test the hypothesis that the construction of access channels will increase the density of fishery organisms. A second experimental project is being conducted in coastal North Carolina to test the importance of accessibility to salt marshes by fishery organisms. Various combinations of experimental plots containing seagrass habitat, reticulated and nonreticulated marsh vegetation, and nonvegetated bottom will be created and tested for their utility for fishery organisms. (See also W88-02563) (Geiger-PTT)
W88-02567

OVERVIEW OF THE BENEFICIAL USES OF DREDGED MATERIAL,
Army Engineer Inst. for Water Resources, Fort Belvoir, VA.
W. R. Murden.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 121-128.

Descriptors: *Dredging, *Wildlife habitat, *Estuarine fisheries, *Spoil disposal, *Waste disposal, *Sediment disposal, *Landfills, *Bank stabilization, *Beneficial use, Estuarine environment, Wetlands, Waterfowl, Environmental effects, Ecological effects, Salt marshes, Aquatic plants, Reefs.

Dredged materials have been used in pre-20th century times for landfills for industrial, commerical and urban development, and the creation of numerous islands in waterways and estuaries. Beach nourishment has been carried out to provide shoreline protection during storms and floods, and to stabilize strands along developed coastal areas. The creation of wetlands using dredged materials can be carried out even in areas subject to moderate wave erosion. Islands created from dredged materials have been used by waterfowl as nesting areas. Aother beneficial use of dredged materials is the development of upland disposal areas such as wildlife habitat or nesting meadows. Aquatic habitat development for beneficial use includes sport and commerical fisheries, gravel riffle beds for endangered or threatened speices, clam beds and oyster reefs, fishing reefs, freshwater aquatic vegetation, seagrass beds, and underwater berns. Dredged materials provide fill for recreational areas and agricultural and grazing land. Dredged material is often used for bank stabilization. Cost efficient options are needed for dredged materials to continue dredging operations which keep open channels of ports and harbors. (See also W88-02563) (Geiger-PTT)
W88-02568

HABITAT DEVELOPMENT APPLICATIONS: THE USE OF DREDGED MATERIAL ISLANDS BY BIRDS IN NORTH CAROLINA,
North Carolina Univ. at Wilmington. Dept. of Biology.
For primary bibliographic entry see Field 5E.
W88-02570

HABITAT DEVELOPMENT APPLICATIONS: USE OF SEAGRASS TRANSPLANTING FOR HABITAT DEVELOPMENT ON DREDGED MATERIAL,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
M. S. Fonseca.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 145-150, 1 fig, 14 ref.

Descriptors: *Dredging, *Marsh plants, *Wildlife habitat, *Environmental effects, *Spoil disposal, *Waste disposal, *Sediment disposal, *Marsh management, Erosion control, Sea grasses, Models, Decision making, Salt marshes, Fisheries.

In 1981, the NMFS Beaufort Laboratory and the CERC began a cooperative agreement to study the transplanting of sea grasses for stabilization of subtidal dredged material and habitat development. Based on sea grass growth models, quantitative definitions of planting success were obtained. These models, coupled with monitoring programs, formed the basis for site selection and project initiation. The studies demonstrated that development of seagrass meadows on subtidal dredged material or physically disturbed bottom is a viable technology given the aforementioned site selection constraints. Work was initiated with an eelgrass

(Zostera marina) transplanting project adjacent to a dredged material island in North Carolina. Results showed that even 10 months after planting, there was an order of magnitude difference in faunal abundance between transplanted and adjacent, natural meadows. This trend will likely continue well into the second year after planting. The project is being expanded using replicate mixed-species sea grass and adjacent monotypic salt marsh plantings on three intracoastal waterway dredged material islands in North Carolina. Combinations of salt marsh with and without access channels and with and without adjacent offshore sea grass beds will be sampled over time for faunal utilization. These areas will be compared to unplanted areas. These studies and others in the Southeast will provide the basis for management decisions regarding sea grass transplanting as a mitigative practice. (See also W88-02563) (Geiger-PTT)
W88-02571

HABITAT DEVELOPMENT APPLICATIONS: MANAGEMENT OF DREDGED MATERIAL IN THE NEW ORLEANS DISTRICT,
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 6G.
W88-02572

HABITAT DEVELOPMENT APPLICATIONS: PRESENT AND POTENTIAL USES OF DREDGED MATERIAL WETLANDS AND ISLANDS BY WATERFOWL AND WATERBIRDS IN CHESAPEAKE BAY,
Fish and Wildlife Service, Annapolis, MD.
R. L. Zepp, H. G. Earhart, and E. W. Garbisch.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 156-167, 2 fig, 1 tab, 9 ref.

Descriptors: *Dredging, *Wildlife habitat, *Waterfowl, *Beneficial use, *Spoil disposal, *Waste disposal, *Sediment disposal, *Marsh management, Salt marshes, Marsh plants, Ecological effects, Bays, Fisheries, Channel improvement, Maintenance, Environmental effects.

Dredged material from the Honga River Federal Channel, Chesapeake Bay, is disposed of on the northeast side of Barren Island. The authorized dredging area is 18.2 m wide, 3,657 m long and 2.1 m deep. The dredging resulted in approximately 250,509 cu m of predominantly fine-grained sediments hydraulically pumped and deposited in the dredged material placement (DMP) site. The DMP site was seeded with Spartina alterniflora and S. patens in 1982 and 1985. A total of 17.5 ha of intertidal and upland wildlife habitat were created in 1982; 4.8 ha were added with the 1985 dredging. After the 1982 disposal, the area stabilized with the exception of the north-northeast corner of the mound which is an area of accretion and active sand movement. Due to the high wave energy on the northern barrier island created during the 1985 dredging, it has migrated and merged with the 1982 island. The unvegetated habitat established for least terns was heavily utilized in the spring and early summer of 1982. Numerous other birds were also counted at the DMP site. In conjunction with the dredged material disposal operation and the resulting reduction in water depths around the perimenter of the island, favorable shallow-water habitat was created for reestablishment of submerged aquatic vegetation. (See also W88-02563) (Geiger-PTT)
W88-02573

INDUSTRIAL AND COMMERCIAL APPLICATIONS: THE POTENTIAL FOR INNOVATION IN THE COMMERCIAL USES OF DREDGED MATERIAL,
Maryland Port Administration, Baltimore.
For primary bibliographic entry see Field 5E.
W88-02577

SPECIAL APPLICATIONS AND CONCEPTS: INNOCENT UNTIL PROVEN GUILTY,
For primary bibliographic entry see Field 5E.
W88-02580

SPECIAL APPLICATIONS AND CONCEPTS: SHORELINE NOURISHMENT--THE GULF ISLANDS NATIONAL SEASHORE EXPERIENCE,
National Park Service, Gulf Breeze, FL. Gulf Islands National Seashore.
For primary bibliographic entry see Field 5E.
W88-02581

COLUMBIA RIVER ESTUARY DATA DEVELOPMENT PROGRAM. ABSTRACTS OF MAJOR CREDDP PUBLICATIONS.
Columbia River Estuary Study Taskforce, Astoria, OR.
Available from the National Technical Information Service, Springfield, Virginia. 22161, as PB84-245422. Price codes: A05 in paper copy, A01 in microfiche. June 1984. 65 p, 32 ref, append.

Descriptors: *Estuaries, *Food chains, *Aquatic productivity, *Sedimentation, *Estuarine environment, Sediment transport, Hydrologic models, Benthos, Photosynthesis, Biomass, Zooplankton, Fish, Marsh plants, Waterfowl, Mammals, Rivers, Primary productivity.

The Columbia River Estuary Data Development Program (CREDDP) was designed to increase understanding of the ecology of the Columbia River Estuary and to provide information useful in making land and water use decisions. CREDDP research is divided into thirteen projects, called work units. Three work units, Emergent Plant Primary Production, Benthic Primary Production, and Water Column Primary Production, deal with the plant life which, through photosynthesis and uptake of chemical nutrients, forms the base of the estuarine food web. These work units describe and map the productivity and biomass patterns of the estuary's primary producers and illustrate the relationship of physical factors to primary producers and their productivity levels. The higher trophic levels in the estuarine food web were the focus of seven CREDDP work units: Zooplankton and Larval Fish, Benthic Infauna, Epibenthic Organisms, Fish, Avifauna, Wildlife, and Marine Mammals. These work units describe and map the abundance patterns of the invertebrate and vertebrate species and discuss these species' relationships to relevant physical factors. The other three work units, Sedimentation and Shoaling, Currents, and Simulation, deal with physical processes. These units characterize and map bottom sediment distribution, sediment transport, and determined the causes of bathymetric change, and model circulation patterns, vertical mixing and salinity patterns. Final reports on all of these thirteen work units are published and a conceptual model of biological processes in the estuary is presented. (See also W88-02563) (Geiger-PTT)
W88-02586

HYDROCARBONS IN THE WATER COLUMN OF THE CARTEAU BAY (GULF OF FOS-SUR-MER, MEDITERRANEAN SEA),
Centre d'Oceanologie de Marseille (France).
For primary bibliographic entry see Field 5B.
W88-02677

REMOTE SENSING OF SUBMERGED AQUATIC VEGETATION IN LOWER CHESAPEAKE BAY: A COMPARISON OF LANDSAT MSS TO TM IMAGERY,
Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, ME.
For primary bibliographic entry see Field 7B.
W88-02678

INFLUENCE OF INPUTS TO THE FIRTH OF FORTH ON THE CONCENTRATIONS OF TRACE METALS IN COASTAL WATERS,
Marine Lab., Aberdeen (Scotland).
For primary bibliographic entry see Field 5B.
W88-02690

DETERMINANTS OF PATTERN IN A NEW ENGLAND SALT MARSH PLANT COMMUNITY,
Brown Univ., Providence, RI. Graduate Program in Ecology and Evolutionary Biology.
For primary bibliographic entry see Field 2I.
W88-02797

COMPARATIVE SURVIVAL OF ANTIBIOTIC-RESISTANT AND -SENSITIVE FECAL INDICATOR BACTERIA IN ESTUARINE WATER,
Massachusetts Univ. at Boston. Environmental Science Program.
For primary bibliographic entry see Field 5A.
W88-02866

ANNUAL BACTERIOPLANKTON BIOMASSES AND PRODUCTIVITIES IN A TEMPERATE WEST COAST CANADIAN FJORD,
Simon Fraser Univ., Burnaby (British Columbia). Dept. of Biological Sciences.
L. J. Albright, and S. K. McCrae.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 6, p 1277-1285, June 1987. 8 fig, 4 tab, 29 ref.

Descriptors: *Bacterioplankton, *Biomass, *Primary productivity, *Fjords, *Estuaries, Phytoplankton, Chlorophyll a, Seawater, Canada, Bacteria.

Bacterioplankton numbers, biomasses, and productivities, as well as chlorophyll a concentrations and phytoplankton productivities, were assayed from 1 March 1984 to 12 August 1985 through a 250-m-deep seawater column in Howe Soud, a temperate fjord-sound on the southern coast of British Columbia, Canada. Primary production during this 18-month period was 845 g C/sq m. Bacterial production was assayed over this same period as 193 g of C/sq m (thymidine incorporation) and 77 g of C/sq m (frequency of dividing cells). Bacterial productivities per cubic meter were usually greater in the euphotic zone than in deeper aphotic water, but when integrated through the water column, approximately half of the bacterial production occurred in the deeper aphotic portion. Bacterial production occurred throughout the year, although at reduced rates in late fall and early winter; primary production almost ceased during late fall and early winter. Because of this heterotrophic bacterioplankton production was a very large portion of the microbial (bacterial plus phytoplankton) production at this time. In mid-summer bacterial production was a small proportion of the microbial production. Because of this asynchrony in peaks and troughs of bacterial and phytoplankton production through the year, data comparison is best done over an annual cycle. On this basis the bacterial production in the Howe Sound water column was between 23 and 9% of the phytoplankton production when a bacterial C to biovolume ratio of 0.107 pg of C/cu micron was assumed; the corresponding values were 64 and 29% when a ratio of 0.300 pg of bacterial C/cu micron was assumed. (Author's abstract)
W88-02868

INCIDENCE OF VIBRIO CHOLERAE FROM ESTUARIES OF THE UNITED STATES WEST COAST,
Food and Drug Administration, Seattle, WA. Seafood Products Research Center.
For primary bibliographic entry see Field 5B.
W88-02871

VIRULENT STRAINS OF VIBRIO VULNIFICUS ISOLATED FROM ESTUARIES OF THE UNITED STATES WEST COAST,
Food and Drug Administration, Seattle, WA. Seafood Products Research Center.
For primary bibliographic entry see Field 5B.
W88-02872

REDUCTION OF SELENATE TO SELENIDE BY SULFATE-RESPIRING BACTERIA: EX-

PERIMENTS WITH CELL SUSPENSIONS AND ESTUARINE SEDIMENTS,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 5B.
W88-02873

EVOLUTION OF BACTERIAL FLORA FROM A SUBTERRANEAN SALINE WELL BY GRADUATED SALINITY CHANGES IN ENRICHMENT MEDIA,
Granada Univ. (Spain).
A. del Moral, E. Quesada, V. Bejar, and A. Ramos-Cormenzana.
Journal of Applied Bacteriology JABAA4, Vol. 62, No. 5, p 465-471, May 1987. 4 fig, 21 ref.

Descriptors: *Evolution, *Bacteria, *Saline wells, *Salinity, Salt tolerance, Taxonomy, Growth, Salts, Temperature.

The bacterial flora of samples taken from a subterranean saline well was enriched (1) by periodic salinity increase and (2) by periodic salinity decrease, both at 25 and 35 C. During the enrichment process, bacterial flora, including halotolerant, marine, moderately and extremely halophilic bacteria, were enumerated. Results were similar at both temperatures. marine bacteria and moderately halophilic micro-organisms were the most favored groups, predominating between 3 and 30% (w/v) salt content; extremely halophilic bacteria also appeared when salinity reached 30% (w/v) and halotolerant bacteria were poorly represented. The taxonomic distribution of 125 selected strains, chosen at random from counting media, was essentially similar to those from other hypersaline environments. (Author's abstract)
W88-02874

POTENTIAL EFFECT OF FLOATING DOCK COMMUNITIES ON A SOUTH CAROLINA ESTUARY,
South Carolina Univ. at Beaufort.
E. A. Caine.
Journal of Experimental Marine Biology and Ecology JEMBAM, Vol. 108, No. 1, p 83-91, June 1987. 2 fig, 1 tab, 22 ref. NSF Grant CDP-8002609.

Descriptors: *Estuaries, *Hydroids, *Floating docks, *Predation, Silversides, Reproduction, Crabs, Food chain, Invertebrates, Fish, Larvae.

A 4-yr study on the motile epibionts colonizing hydroids on a floating dock in a South Carolina estuary indicated that the motile epibiotic community were preyed upon by fish, especially when the Atlantic silverside (Menidia menidia (L.)) became reproductively active and deposited eggs among the hydroids during the spring. When fish predation reduced the number of amphipods within the epibiotic community, crab megalopa colonized the hydroids. Crabs developed into juveniles and emigrated from the epibiotic community after 6-8 wk residence. The community on floating docks may be an important food source for some nekton and may recruit some benthic invertebrates. Although preferential larval settlement and fish predation are intuitive processes associated with floating dock communities, insufficient research has addressed the relationships in soft-bottom areas devoid of naturally occurring hard substrata. (Author's abstract)
W88-02877

TRACE METAL REDUCTION BY PHYTOPLANKTON: THE ROLE OF PLASMALEMMA REDOX ENZYMES,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
G. J. Jones, B. P. Palenik, and F. M. M. Morel.
Journal of Phycology JPYLAJ, Vol. 23, No. 2, p 237-244, June 1987. 8 fig, 1 tab, 33 ref.

Descriptors: *Water chemistry, *Trace metals, *Phytoplankton, *Enzymes, *Plasmalemma, Copper, Iron, Reduction, Complexes, Metals, Diatoms, Ions.

The phytoplankton cell surface reduces external copper(II) and iron(III) complexes and redox dyes. This reductive activity appears to be mediated by one or more plasmalemma redox enzymes. Trace metal complexes are directly reduced by the redox enzyme, therefore the reduction rate is not regulated by the metal free ion activity in solution. This is in direct contrast to previous measurements of trace metal interactions with the phytoplankton cell membrane. Half-saturation constants for the reduction of Cu(II) complexes with carbonate, phenanthroline and bathocuproinedisulfonate are in the range 2.3-14.7 micronmolar, which suggests that trace metal complexes are not the main electron acceptor in natural waters. In the diatom Thalassiosira weissflogii there is additional reductive activity associated with the cell wall. (Author's abstract)
W88-02878

NEUTRON ACTIVATION AND ATOMIC ABSORPTION ANALYSIS OF ULVA LACTUCA AND GRACILARIA VERRUCOSA FROM THERMAIKOS GULF, GREECE,
Sofia Univ. (Bulgaria). Khimicheski Fakultet.
For primary bibliographic entry see Field 5A.
W88-02880

EUTROPHICATION ASSESSMENT IN GREEK COASTAL WATERS,
Institute of Oceanographic and Fisheries Research, Athens (Greece).
For primary bibliographic entry see Field 5C.
W88-02882

EFFECTS OF TRACE METALS ON GROWTH OF RED TIDE PHYTOPLANKTON AND THEIR ACCUMULATION OF METAL,
Government Industrial Research Inst., Chugoku, Kure (Japan).
H. Fuse.
Agricultural and Biological Chemistry ABCHA, Vol. 51, No. 4, p 987-992, April 1987. 5 fig, 1 tab, 25 ref.

Descriptors: *Nutrients, *Algae, *Bioaccumulation, *Trace metals, *Phytoplankton, *Red Tide, Heavy metals, Copper, Growth, Manganese, Zinc, Iron.

The effects of six trace metals on the growth of five species of phytoplankton were examined and their uptake of these metals was investigated. Chattonella antiqua was sensitive to high cupric ion activities with a prolonged lag phase when the activity was 10 to the minus 12.8 power. The growth of Gymnodinium nelsoni was slowed by low manganese activities and stopped at the activity of 10 to the minus 11 power. Thalassiosira sp., C. antiqua, and Heterosigma akashiwo were affected by low zinc ion activities and H. akashiwo was affected by low cupric ion activities. All species but Dunaliella sp. were affected by low iron concentrations. The cellular copper level of Dunaliella sp., the cellular manganese level of Thalasiosira sp., and the cellular zinc level of H. akashiwo were saturated. Thalasiosira sp. could accumulate about 32 times as much manganese as its minimum cell requirement. (Author's abstract)
W88-02885

STUDY OF THE INVERTEBRATES AND FISHES OF SALT MARSHES IN TWO OREGON ESTUARIES,
Coastal Engineering Research Center, Fort Belvoir, VA.
D. L. Higley, and R. L. Holton.
Available from the National Technical Information Service, Springfield, VA 22161as ADA-106973, A08 in paper copy, A01 in microfiche. Miscellaneous Report No. 81-5, June 1981. 132 p, 24 fig, 7 tab, 6 append, 37 ref. Contract No. DACW72-77-C-0013. Project No. G31534.

Descriptors: *Estuaries, *Invertebrates, *Marshes, *Aquatic life, *Fish, Food chains, Aquatic habitats, Habitats, Aquatic animals, Detritus, Salt marshes, Tidal marshes, Siletz Bay, Netarts Bay, Oregon, Aquatic insects, Aquatic plants, Isopods, Crustaceans, Amphipods, Food habits, Polychaetes, Oligochaetes, Homoptera.

A baseline and food chain study of invertebrate and fish life was done in the estuarine tidal marshes of Siletz and Netarts Bay, Oregon. Sweep nets, corers, enclosures, and samplers were used to sample invertebrates in level marsh, pan, tidal creek, and tidal flat habitats located in seven study areas representing various types of marsh. Fish were sampled by seine and otter trawls. Community taxonomic composition and trophic structure, along with fish stomach contents, are presented as relative frequency histograms and pie charts. Dominant invertebrate taxa in terrestrial collections were Acarina, Homoptera, and Diptera, and in aquatic collections were Capitellidae (polychaeta), Oligochaeta, Gnorimosphaeroma (Isopoda), and Anisogammarus and Corophium (Amphipoda). Three-spine stickleback and young staghorn sculpin were the most common fish species through the marsh zone; juvenile salmonids and other species were captured only in submerged level marshes and in a slough. Detrivores and scavengers dominated the invertebrate communities. The herbivore component increased from low marsh to high marsh and was the dominant trophic type in the higher vegetation of the high marsh. Araneae was the predominant invertebrate carnivore in the terrestrial communities. Fish consumed primarily aquatic animals even where terrestrial foods were available. The detritus food chain appears more important than the grazing food chain in the terrestrial communities, and transfer of marsh products to aquatic food chains is predominantly through the export of detritus rather than by the direct consumption of terrestrial animals. (Cassar-PTT)
W88-02922

PHYSICAL AND CHEMICAL DATA FOR NORTHERN SAN FRANCISCO BAY, CALIFORNIA, SEPTEMBER THROUGH NOVEMBER 1984,
Geological Survey, Menlo Park, CA. Water Resources Div.
A. Y. Ota, L. E. Schemel, and S. W. Hager.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-228, 1986. 32 p, 1 fig, 4 tab, 22 ref.

Descriptors: *Water quality, *San Francisco Bay, *California, Bays, Water temperature, Salinity, Fluorescence, Chlorophyll, Alkalinity, Suspended particulate matter, Dissolved organic carbon, Dissolved inorganic nutrients.

This report presents physical and chemical data for northern San Francisco Bay waters. Samples were collected during the late summer and fall of 1984 during six cruises at near-two-week intervals. Bay waters were sampled at designated (historical) stations and selected salinitis along the deep channel of northern San Francisco Bay. Measurements included temperature, salinity, turbidity, in vivo fluorescence, chlorophyll a, alkalinity, suspended particulate matter, dissolved organic carbon, and dissolved inorganic nutrients: nitrite, nitrate + nitrite, ammonium, dissolved silica, and ortho-phosphate. Numerical results are tabulated and methods are described. (USGS)
W88-03066

DATA ON THE DISTRIBUTION AND ABUNDANCE OF SUBMERSED AQUATIC VEGETATION IN THE TIDAL POTOMAC RIVER, MARYLAND, VIRGINIA, AND THE DISTRICT OF COLUMBIA, 1985,
Geological Survey, Reston, VA. Water Resources Div.
N. B. Rybicki, R. T. Anderson, J. M. Shapiro, C. L. Jones, and V. Carter.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-126, 1986. 49 p, 3 fig, 22 tab, 12 ref.

Descriptors: *Submerged aquatic vegetation, *Submersed vegetation, *Potomac River, Macrophytes, Aquatic weeds, Vegetation maps, Maryland, Virginia, District of Columbia.

This report summarizes data on the distribution and abundance of submersed aquatic vegetation

collected in the tidal Potomac River during 1985. Plant species were identified and dry weight determined for selected sites. Information on competition between Hydrilla verticillata and other species was measured. Water-quality characteristics measured include temperature, specific conductance, dissolved oxygen, pH, and transparency as indicated by Secchi depth. A map was made of the distribution of submersed aquatic vegetation based on transect samples and a complete shoreline survey. (USGS)
W88-03130

EVALUATION OF MANATEE HABITAT SYSTEMS ON THE NORTHWESTERN FLORIDA COAST,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 6G.
W88-03289

TRACE METALS IN SAN FRANCISCO BAY, CALIFORNIA: A PRELIMINARY REPORT,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W88-03314

HYDROLOGY OF FRITCHIE MARSH IN COASTAL LOUISIANA AND APPLICATION OF FINITE-ELEMENT MODELING TO DETERMINE FLOW,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03465

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

SIMPLIFIED TEST FOR SOLAR WATER PURIFICATION,
New Mexico Solar Energy Inst., Las Cruces.
C. M. Redman.
New Mexico Water Resources Research Institute Technical Completion Report. February 1983. 22 p, 6 fig, 6 tab.

Descriptors: *Solar distillation, *Evaporation, *Solar stills, *Water treatment, *Water shortage, Solar energy, Filtration.

The depleting of the Ogallala aquifer and the accompanying loss of valuable irrigated farmland is an example of the serious water problems facing New Mexico and the country. In this research project, on-hand equipment was used to determine if a solar-driven, low-pressure, low temperature water purification system would be technically and economically practical. This technique used an unglazed solar panel as a heater during cooler periods of isolation. It used a 30-gallon insulated hot water tank for water storage, with domestic water in the tank to simulate brackish, gray or salt water. Plumbing was added to allow solar heating of the water via thermosiphon and nocturnal low-pressure evaporation by means of a hydrostatic column of water. The findings showed that the water could be heated via the unglazed solar panel during the day, evaporated at night in the raw water tank, and condensed in the solar panel. Problems with the pressure gauge and air leaks were solved by obtaining a new gauge and careful sealing of the system. While it was concluded that the technique works, it is recommended that an improved system be constructed and tested using vacuum-type valves and a better solar panel to determine the system's success and feasibility. The system's low cost in terms of construction materials and energy use is much below that of present techniques, such as reverse osmosis, ultrafiltration and ion exchange to purify brackish and salt water. (Hawkins-PTT)
W88-02963

SIMPLIFIED TEST FOR SOLAR WATER PURIFICATION,
New Mexico Water Resources Research Inst., Las Cruces.
C. M. Redman.
WRRI Technical Completion Report No. 160, March 1983. 22 p, 6 fig.

Descriptors: *Water supply, *Desalination, *Solar distillation, Brackish water, Saline water, Water purification, Water treatment, Distillation, Wastewater treatment.

A solar-driven, low-pressure solar still was constructed from a low-cost 32-sq ft unglazed FAFCO solar panel, which served as a heater during sunny periods and as a vapor condenser during cloudy or cool periods. A 30-gallon insulated hot water tank was used for water storage. Plumbing was added to allow solar heating of the water by thermosiphon and nocturnal low-pressure evaporation by means of a hydrostatic column of water. Although the testing showed that the apparatus worked, problems with the pressure gage and air leakage prevented determination of how well it worked. (Cassar-PTT)
W88-02967

3B. Water Yield Improvement

ATTEMPT TO NORMALIZE THE HAILSTORM VARIABILITY FOR THE EVALUATION OF CLOUD SEEDING,
Research Council of Alberta, Edmonton. Atmospheric Sciences Dept.
L. Cheng.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 26, No. 4, p 443-456, April 1987. 10 fig, 2 tab, 27 ref.

Descriptors: *Hail, *Cloud seeding, *Storms, *Kinetics, *Statistical analysis, Thermodynamics.

Procedures have been developed from relationships between parameters of hailstone size distributions and storm thermodynamics to normalize the effects of storm thermodynamics of integral hail parameters observed at the ground. Hail parameters considered in this study are the number concentration, water content and kinetic energy. Results from statistical tests on these integral hail parameters obtained from various not-seeded storms showed that significant differences exist among these storms. The differences appear to be due to variations in storm intensity. However, once the normalization of the storm thermodynamic variability is applied to the data, no significant differences are found. The technique seems to reduce, if not eliminate, the variations due to the effects of storm thermodynamics on the integral hail parameters. Statistical analyses of the normalized surface integral hail parameters, obtained from two operationally seeded storms, are carried out to test the procedure for the evaluation of silver iodide seeding effects. A storm-by-storm approach is used to illustrate the anthropogenic variability such as differences in the execution of the seeding operation. Integral hail parameters obtained from a storm that is not seeded at the appropriate location as prescribed by the seeding hypothesis do not differ from those of the control storms. For the other storms seeded at the right location, a nominally significant difference is found in the hail total number concentration but not in the integral hail water content and kinetic energy. However, no conclusion as to the cause of the isolated significant difference can be drawn because the storms analyzed did not constitute a randomized experiment. (Author's abstract)
W88-02681

EARLY-SEASON SNOW AND SKIER VISITS IN COLORADO,
Colorado Dept. of Natural Resources, Denver.
L. A. Sherretz, and W. Loehr.
November 1983. Bureau of Reclamation, Denver, Colorado. 19 p, 9 fig, 4 tab, 3 ref, append.

Descriptors: *Weather modification, *Snow cover, *Recreation, *Cloud seeding, *Skiing, *Colorado, Environmental effects, Economic aspects, Economic growth, Mountains.

The relationship of skier visits to early-season snow depth is strong at Aspen Mountain, Buttermilk, Snowmass, and Vail, which primarily serve persons who plan trips fairly far in advance, and weak at Copper Mountain and Winter Park, which primarily serve day skiers. Conservative estimates of the additional retail expenditures generated by a 15% increase in early-season snow cover in a dry winter (possible with cloud seeding) were $945,000 at Aspen, $495,00 at Buttermilk, $648,000 at Copper Mountain, $2,110,000 at Snowmass, $9,541,000 at Vail, and $464,000 at Winter Park. (Cassar-PTT)
W88-02932

SATELLITE SUPPORT TO THE SIERRA COOPERATIVE PILOT PROJECT: 1979/80 AND 1980/81,
Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
For primary bibliographic entry see Field 7B.
W88-02943

3C. Use Of Water Of Impaired Quality

RESPONSE OF COTTON, ALFALFA, AND CANTALOUPE TO FOLIAR-DEPOSITED SALT IN AN ARID ENVIRONMENT,
Arizona Univ., Tucson. Dept. of Plant Sciences.
For primary bibliographic entry see Field 5C.
W88-02721

LAND TREATMENT OF MUNICIPAL WASTEWATER: VEGETATION SELECTION AND MANAGEMENT.
For primary bibliographic entry see Field 5E.
W88-02741

SELECTION OF IRRIGATION SYSTEM DESIGN,
Williams and Works, Grand Rapids, MI.
For primary bibliographic entry see Field 5E.
W88-02743

WASTEWATER CROP MANAGEMENT STUDIES IN MINNESOTA,
Minnesota Univ., St. Paul. Agriculture Extension Service.
For primary bibliographic entry see Field 5E.
W88-02744

CROP MANAGEMENT STUDIES AT THE MUSKEGON COUNTY MICHIGAN LAND TREATMENT SYSTEM,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 5E.
W88-02745

COMPARISON OF THE CROP MANAGEMENT STRATEGIES DEVELOPED FROM STUDIES AT PENNSYLVANIA STATE UNIVERSITY, UNIVERSITY OF MINNESOTA, MICHIGAN STATE UNIVERSITY, AND THE MUSKEGON COUNTY LAND TREATMENT SYSTEM,
Georgia Coastal Plain Experiment Station, Tifton.
For primary bibliographic entry see Field 5E.
W88-02746

MANAGEMENT STUDIES OF ANNUAL GRASSES AND PERENNIAL LEGUMES AND GRASSES AT THE MICHIGAN STATE UNIVERSITY WATER QUALITY MANAGEMENT FACILITY,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 5E.
W88-02747

OLDFIELD MANAGEMENT STUDIES ON THE WATER QUALITY MANAGEMENT FACILITY AT MICHIGAN STATE UNIVERSITY,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 5E.
W88-02748

VEGETATION SELECTION AND MANAGEMENT FOR OVERLAND FLOW SYSTEMS,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 5D.
W88-02749

GROWING TREES ON EFFLUENT IRRIGATION SITES WITH SAND SOILS IN THE UPPER MIDWEST,
North Central Forest Experiment Station, East Lansing, MI.
For primary bibliographic entry see Field 5E.
W88-02750

TREE SEEDLING RESPONSES TO WASTEWATER IRRIGATION ON A REFORESTED OLD FIELD IN SOUTHERN MICHIGAN,
Michigan Dept. of Natural Resources, Lansing. Water Quality Div.
For primary bibliographic entry see Field 5E.
W88-02751

STUDIES OF LAND APPLICATION IN OLD GROWTH FORESTS IN SOUTHERN MICHIGAN,
Michigan State Univ., East Lansing. Dept. of Zoology.
For primary bibliographic entry see Field 5E.
W88-02752

PLANT DISEASES ASSOCIATED WITH MUNICIPAL WASTEWATER IRRIGATION,
Michigan State Univ., East Lansing. Dept. of Botany and Plant Pathology.
For primary bibliographic entry see Field 2I.
W88-02753

CASE STUDY TO ASSESS THE POTENTIAL FOR SALINE SOIL DEVELOPMENT DUE TO IRRIGATION,
Alberta Univ., Edmonton. Dept. of Geology.
For primary bibliographic entry see Field 2G.
W88-02764

ORGANIC CONTAMINANTS REMOVAL FOR POTABLE REUSE,
Denver Water Dept., CO.
For primary bibliographic entry see Field 5D.
W88-02850

EFFECTS OF RESIDUAL SOIL SALINITY RESULTING FROM IRRIGATION WITH SULPHATE WATERS ON LETTUCE,
Agricultural Research Inst., Nicosia (Cyprus).
I. Papadopoulos.
Plant and Soil PLSOA2, Vol. 97, No. 2, p 171-177, February 1987. 5 tab, 21 ref.

Descriptors: *Saline soils, *Salinity, *Soil chemistry, *Water pollution effects, *Irrigation, *Sulfates, *Lettuce, *Salt tolerance, Chemical composition, Saline water, Chemical properties, Sodium, Chlorides, Rain, Ions, Greenhouses, Gypsum, Leaching, Adsorption, Crop yield, Agronomy, Soil-water-plant relationships, Irrigation water.

The response of lettuce to residual soil salinity as influenced by the ionic composition of two different saline waters and rainwater was investigated in the greenhouse with three successive plantings of lettuce in the same soil. One of the saline waters was saturated with gypsum and the other contained sulfate and Na and Cl, respectively (mixed water). Soil water salinity and sodium adsorption ratio increased in both cases using saline waters. The effect of mixed saline water was higher and became more marked after each planting, resulting from higher contributions of Na and Cl to soil salinity. Soil solution became saturated with gypsum, with both saline waters. At first planting, gypsum saturated and mixed waters produced fresh yield increases of 15% and 24%, respectively, relative to rainwater. At second planting, yield was reduced by 11% and 22%, respectively, relative to rainwater, at third planting, yield reduced by 22% and 76% with gypsum-saturated and mixed water, respectively. (Author's abstract)
W88-03215

SALT TOLERANCE OF FOUR TOMATO HYBRIDS,
Centro de Edafologia y Biologia Aplicada del Segura, Murcia (Spain).
V. Martinez, A. Cerda, and F. G. Fernandez.
Plant and Soil PLSOA2, Vol. 97, No. 2, p 233-242, February 1987. 1 fig, 4 tab, 14 ref.

Descriptors: *Salt tolerance, *Tomatoes, *Saline soils, *Lysimeters, *Minerals, Conductivity, Irrigation water, Plant pathology, Agronomy, Soil-water-plant relationships, Salinity, Chemical properties, Fruit crops, Crop yield, Tissue analysis, Leaves.

A greenhouse lysimeter experiment was conducted to evaluate the response of tomato hybrids to varying levels of salinity using four tomato hybrids grown at four salinity levels. The soil was saturated prior to transplanting by irrigating with waters that were prepared by adding NaCl to tap water. The electrical conductivities of the irrigation waters were 1.8, 4.5, 7.0, and 9.5 dS/m at 25 C. Yield, fruit quality, and leaf mineral composition were measured. Fifty percent of fruit yield reduction for all hybrids was associated with a soil salinity of 5.1 dS/m. Each unit increase in salinity above 2 dS/m reduced yield by 14%. This indicates that these tomato hybrids are more salt sensitive than the older varieties. Fruit quality and leaf mineral composition were also affected by salinity and hybrid. (Doria-PTT)
W88-03216

DISTRIBUTION, LENGTH AND WEIGHT OF ROOTS IN YOUNG PLANTATIONS OF EUCALYPTUS GRANDIS W. HILL EX MAIDEN IRRIGATED WITH RECYCLED WATER,
Victoria Dept. of Conservation, Forests and Lands, State Forests and Lands Service, Melbourne (Australia).
P. J. Baldwin, and H. T. L. Stewart.
Plant and Soil PLSO9A2, Vol. 97, No. 2, p 243-252, February 1987. 3 fig, 3 tab, 16 ref.

Descriptors: *Roots, *Eucalyptus, *Recycling, Australia, *Water reuse, *Australia, *Wastewater irrigation, Irrigation, Wastewater renovation, Wastewater, Municipal wastewater, Trees, Soil horizons.

The root systems of Eucalyptus grandis irrigated with recycled municipal effluent were studied at two sites in Victoria, Australia. The vertical distributions of root intercepts, length and weight measurements were similar at both sites. Root length was greatest in the 0-10 cm soil horizon, and intercepts of roots <1 mm in diameter comprised 73% to 81% of all roots. Roots <1 mm in diameter contributed 85% of total length at both sites, and 19% to 21% of total weight. With uniform application of effluent at Mildura, root intercepts and length were concentrated in the center of the irrigation bay, but at Robinvale, the concentration occurred closer to the tree row because of the different method of irrigation (micro-sprays covering only 70% of the ground surface area). Root densities of 0.11 to 0.57 cm/cu cm were estimated, similar to root densities measured in Pinus radiata plantations but considerably lower than those estimated for pastures. The implications of the results for the management of irrigated plantations of eucalypts are discussed. (Doria-PTT)
W88-03217

3D. Conservation In Domestic and Municipal Use

DEMAND FOR URBAN WATER BY CUSTOMER CLASS,
Northern Illinois Univ., De Kalb.
For primary bibliographic entry see Field 6D.
W88-02801

3E. Conservation In Industry

COST STRUCTURE OF THE WATER UTILITY INDUSTRY,
Southern Methodist Univ., Dallas, TX.
For primary bibliographic entry see Field 6C.
W88-02802

WATER REUSE IN THE U.S. STEAM ELECTRIC POWER INDUSTRY--AN ASSESSMENT OF CURRENT PRACTICE AND POTENTIAL FOR FUTURE APPLICATIONS,
Dames and Moore, Bethesda, MD.
For primary bibliographic entry see Field 5D.
W88-03145

3F. Conservation In Agriculture

SUDAN: THE RAHAD IRRIGATION PROJECT,
Agency for International Development, Washington, DC.
P. Benedict, A. H. Ahmed, R. Ehrich, and S. F. Lintner.
Available from the National Technical Information Service, Springfield, Virginia. 22161, as PB84-242676. Price codes: A09 in paper copy, A01 in microfiche. A.I.D. Project Impact Evaluation Report No. 31, March 1982. 125 p, 6 tab, 56 ref, 8 append.

Descriptors: *Irrigation programs, *Irrigation effects, *Irrigation design, *Sudan, *Public health, *Evaluation, Automation, Irrigation efficiency, Irrigation practices, Water management, Developing countries, Water policy, Crop production, Labor.

Although the Rahad Irrigation Project in Sudan, partly AID-funded and nearly complete, has been operating for only four seasons, it faces problems which threaten its viability. This report assesses these problems, the project's impact, and the lessons learned. Designed to maximize use of government investments in Nile water management, to upgrade the living standards of 100,000 herders and farmers, and to produce cotton and groundnuts for export, the project is pursuing full mechanization and 100% intensive rotation of crops. Production is supervised by the Rahad Corporation which controls pricing, marketing, and most decision-making. The Corporation has not coped well with several problems - managing a mechanized operation, erroneously perceived labor shortages, and tenant dissatisfaction. Faced with little incentive to grow cotton, farmers have produced less and are working as day laborers and raising livestock, sorghum, and groundnuts. Mechanization has further reduced project-generated income and threatens to displace labor. In addition, limitations on local currency have resulted in the inadequate and unequal provision of educational, health, and other promised services. Among the lessons taught by the project are that: a policy of 100% mechanization needs more analysis; farmers must be given a role in the decision-making process and be allowed choices; harvest-time labor shortages must be viewed in relation to prevailing wage rates; environmental analyses must be conducted and used in designing and implementing irrigation projects; programs to control water-borne diseases should be designed and funded in irrigation projects; and crop protection techniques should be reviewed prior to project implementation and coordinated with public health officials. (See also W88-02563) (Author's abstract)
W88-02585

COMPUTERIZED SUPERVISION AND CONTROL OF DUJAILAH IRRIGATION PROJECT,
Baghdad Univ. (Iraq). Coll. of Engineering.
N. K. Wafi, and A. I. Y. Mohammed.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 213-222, 3 fig, 1 tab.

Descriptors: *Computers, *Dujailah project, *Iraq, *Irrigation practices, *Automation, *Data acquisition, Irrigation, Drainage water.

The Dujailah project, located approximately 200 km southeast of Baghdad, Iraq, is an integrated agro-industrial complex. It contains farms and orchards, animal and poultry farms in addition to dairy and food processing industries. The project evolves around a planned central city complete with services including an institute for agricultural technicians. The irrigation network consists of four primary canals totalling 43 km in length and secondary canals 41 km long. Branching from these canals is a network of pipe feeders with hydrants for field plot irrigation. The project employs surface irrigation methods whereby border strips 15 m wide and 284 m long are formed on either side of the pipe feeders. Each hydrant has a basic flow rate of 28 L/s and irrigates a strip on either side (two-sided irrigation). All flow in the system is by gravity. The drainage network follows a similar pattern with covered field drains and secondary and primary open drains. All drainage water flows by gravity to a pumping stsation at the northeastern corner of the project. The Dujailah Supervision and control system consists of the System Control Center, 52 outstations (one for each control regulatory or gate) and the telecommunication network. The basic functions of the system are: data acquisition, data and information communication, processing of data and information, control, display and supervision of output, and elaboration of operation instruction commmands and alarms. In addition to econo-technical justifications, the design and implementation of the remote control system was subject to the following requirements: reliability, data transmission, accuracy and delay restrictions; interface with gate and telecommunication network equipment; accuracy of transmitted measurements and set point values; and system flexibility and possibility of future expansion. (See also W88-02617) (Lantz-PTT)
W88-02636

FIELD TEST OF A SIMPLE SOIL-WATER BALANCE MODEL FOR IRRIGATED AREAS,
Indian Agricultural Research Inst., New Delhi. Water Technology Center.
For primary bibliographic entry see Field 2G.
W88-02774

EFFICIENCY IN WATER ALLOCATION UNDER STOCHASTIC DEMAND,
California Univ., Santa Barbara.
For primary bibliographic entry see Field 6D.
W88-02800

GROWTH HABITS OF WATER-STRESSED WHEAT SEEDLINGS AS SELECTION CRITERIA FOR DROUGHT RESISTANCE,
Department of Agriculture, Lethbridge (Alberta). Research Station.
R. Kaul, and H.-H. Mundel.
Annals of Botany ANBOA4, Vol. 59, No. 6, p 653-656, June 1987. 1 fig, 2 tab, 8 ref.

Descriptors: *Plant growth, *Water stress, *Wheat, *Seedlings, *Drought resistance, Food crops, Agriculture, Drought, Genotypes, Crop yield, Prediction.

A technique is described to induce slowly increasing water deficits in wheat (Triticum aestivum L.) seedlings by rooting them in damp vermiculite and growing them in a humid atmosphere. After eight weeks, drought-resistant genotypes can be identified either by drought avoidance or by drought tolerance responses. Genotypes with lesser drought resistance become dormant or produce sterile spikes. The test roughly predicts the relative yield performance of cultivars in dry field conditions. (Author's abstract)
W88-02875

IRRIGATION EVALUATIONS AND IMPROVEMENTS IN NEW MEXICO TO CONSERVE WATER AND ENERGY,
New Mexico Water Resources Research Inst., Las Cruces.
R. B. Hulsman.
WRRI Technical Completion Report No. 174, Las Cruces, September 1983. 74 p, 46 fig, 11 tab, 12 ref, append.

Descriptors: *Water conservation, *Irrigation efficiency, *Uniformity coefficient, Surface irrigation, New Mexico, Conservation, Water distribution, Soil water, Agriculture, Water requirements, Alfalfa, Barley, Chile peppers, Cotton, Cucumbers, Lettuce, Onions, Pecans, Wheat, Water use efficiency.

Sixteen on-farm, closed border, surface irrigation systems were evaluated over a three-year period in Dona Ana County, New Mexico. One hundred forty-one individual and 16 seasonal irrigation efficiencies were calculated along with 378 distribution uniformities and the same number of coefficients of uniformity. Wide variations in individual efficiencies (1.24 to 232.5 percent), seasonal efficiencies (22.61 to 124.77 percent), distribution uniformities (20.3 to 96.37 percent), and coefficients of uniformity (55 to 98 percent) indicate the potential for considerable savings in water and energy resources. These savings have been presented in tabular form for water, energy, and cost resources. (Author's abstract)
W88-02966

DRAINAGE-SUBIRRIGATION SYSTEM EVALUATION FOR GEORGIA FLATWOODS,
Georgia Coastal Plain Experiment Station, Tifton.
A. Shirmohammadi, D. L. Thomas, E. D. Threadgill, and F. Da Silva.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-164175/AS. Price codes: A04 in paper copy, A01 in microfiche. Report No. ERC 03-85. Environmental Resources Center, Georgia Institute of Technology, Atlanta. August 1985. 42 p, 2 fig. 30 ref. Project No. USGS G-900-07.

Descriptors: *Irrigation, *Subirrigation, *Tile drainage, *Georgia water use, Drainage, Soil water movement.

Drainage-subirrigation was studied on the SEAMAR farm in Pierce County, Georgia on Pelham loamy sand soil. The study area included 40 hectares of land (38 in blueberries, 1 in corn and 1 in soybeans). The system included two drain spacings of 15.3 and 20 m. Two water table management system were used: an open ditch and a closed system network. Seventeen punch-tape water level recorders were used to measure the water level in the soil profile at midfield (on tiles and midway between the tiles), at the open ditch and closed system control structures (one for each), and in an undrained-nonirrigated section of the farm. A punch-tape rainfall recorder was also used to measure rainfall at the site. Excessive drainage early in the growing season coupled with a slow subirrigation phase due to deep drain tiles resulted in poor performance of the system in the corn field. Proper management of the system in the blueberry field resulted in favorable soil water conditions and excellent crop growth. DRAINMOD, a water management model for shallow water table conditions, was used to simulate the system performance for Flatwoods soils. The results indicate that a drain spacing of 18-20 m is appropriate for combined drainage-subirrigation systems for soils similar to those in Pierce County. A combined drainage-subirrigation system proved to be an appropriate water management scheme for the Flatwoods of south Georgia. This system, if properly designed, can save up to $144/ha.yr and $129/ha.yr when compared to center pivot/drainage and traveling gun/drainage systems, respectively. More water is needed to achieve the same useable application amount than for other systems (center pivot/drainage and traveling gun/drainage). (Shirmohammadi-U GA)
W88-03157

IMPROVED EMITTER AND NETWORK SYSTEM FOR WASTEWATER REUSE IN DRIP IRRIGATION,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 5D.
W88-03158

SOIL WATER CONSERVATION UNDER ZERO- AND CONVENTIONAL TILLAGE SYSTEMS ON THE CANADIAN PRAIRIES,
Saskatchewan Univ., Saskatoon. Saskatchewan Inst. of Pedology.
M. C. Grevers, J. A. Kirkland, E. De Jong, and D. A. Rennie.
Soil & Tillage Research SOTRD5, Vol. 8, No. 1-4, p 265-276, November 1986. 4 fig, 4 tab, 8 ref.

Descriptors: *Water conservation, *Soil water, *Tillage, *Cultivation, *Canada, *Prairies, *Soil-water-plant relationships, Conservation, Nitrogen, Crop yield, Water level, Recharge, Seasonal variation, Seedlings, Evaporation, Water use, Water use efficiency, Wheat, Snowmelt, Soil types, Loam, Clays, Soil conservation.

The soil water balance under different tillage systems and the effect of spring nitrogen and water levels were investigated on crop yields in the Canadian Prairies. Results from 12 site-years indicate that soil water recharge during the autumn to seeding period was greater under zero tillage than under conventional tillage, probably due to reduced soil water evaporation during the periods from snowmelt to seeding. Water use efficiency was 49.7 kg/ha wheat per cm water under conventional tillage. Under zero tillage, water use efficiencies varied with soil texture, ranging from 53.7 to 186 kg/ha wheat per cm water for loam and heavy clay, respectively. Wheat yield was well correlated with both available nitrogen and water content in spring. Nitrogen was more limiting under zero tillage than under conventional tillage. The crop response to available nitrogen was two times greater under zero tillage compared with conventional tillage. Soil water was more limiting under conventional tillage. The crop response to soil moisture content was four times greater under conventional tillage compared with zero tillage. Soil water depletion during the growing season essentially followed the same pattern under both tillage systems. (Author's abstract)
W88-03194

STUBBLE-MULCH EQUIPMENT FOR SOIL AND WATER CONSERVATION IN THE GREAT PLAINS,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
R. R. Allen, and C. R. Fenster.
Journal of Soil and Water Conservation JWSCA3, Vol. 41, No. 1, p 11-16, January-February 1986. 1 tab, 36 ref.

Descriptors: *Great Plains, *Mulching, *Cultivation, *Soil conservation, *Water conservation, *Reviews, Conservation, Agriculture, History.

The history of the development of conservation machines in the Great Plains is reviewed. Topics discussed include the emergency tillage cultivator, Noble's blade, the stubble-mulch concept, the spread of experimentation, Central Plains research, chemical fallow, seeding through residue, and air seeders. It is concluded that stubble-mulch culture is a reality in the Great Plains. Development of stubble-mulch equipment and systems in North America spanned a period of 70 years, involving the combined efforts of farmers, scientists, and extension personnel. While improvements continue, the early developments proved to be the catalyst for improved farming practices that reduce

soil erosion and use limited supplies of water more efficiently. (Doria-PTT)
W88-03207

IRRIGATION TRASH SCREENS PAY,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
W. D. Kemper, J. A. Bondurant, and T. J. Trout.
Journal of Soil and Water Conservation JWSCA3, Vol. 41, No. 1, p 17-20, January-February 1986. 5 fig, 1 tab, 6 ref.

Descriptors: *Trash screens, *Irrigation design, *Irrigation effects, *Cost-benefit analysis, Irrigation, Irrigation engineering, Engineering, Furrows, Erosion, Soil erosion, Economic aspects, Performance evaluation, Water conservation.

The erosion of soil in irrigated row crops is compounded by trash in the irrigation water, which increases runoff and erosion problems. It is suggested that, for most irrigation farmers, screens to remove trash from incoming water are a sound investment, not only to reduce soil erosion, but to improve the cost-effectiveness of irrigation. The cost of trashy water and the use of trash screens are discussed. Cost of trash removal installations is generally between $100 and $500. It is concluded that, for farmers with appreciable trash in their irrigation water, labor, water, and soil savings, along with increases in production because of improved irrigation, will more than pay for the installation during the first season. Aluminum screens last a year or two, while stainless steel screens have lasted more than five years. The main part of the installation should last at least 10 years. (Doria-PTT)
W88-03208

WATER STORAGE AND USE BY SPRING WHEAT UNDER CONVENTIONAL TILLAGE AND NO TILL IN CONTINUOUS AND ALTERNATE CROP-FALLOW SYSTEMS IN THE NORTHERN GREAT PLAINS,
North Dakota State Univ., Fargo.
E. J. Deibert, E. French, and B. Hoag.
Journal of Soil and Water Conservation JWSCA3, Vol. 41, No. 1, p 53-58, January-February 1986. 8 tab, 24 ref.

Descriptors: *Water storage, *Water use, *Accumulation, *Wheat, *Cultivation, *Soil-water-plant relationships, *Tillage, *Great Plains, *Crop production, *Fallowing, Storage, Agronomy, Profiles, Soil profiles, Evapotranspiration, Crop yield, Weeds, Water use efficiency.

A five-year study was conducted at two North Dakota locations to evaluate water storage and use by spring wheat under no-till and conventional tillage in continuous and alternate crop-fallow systems. Storage efficiency during the nongrowing season under continuous wheat culture varied among years and locations, but was similar among tillage systems. No-till grain yields were generally lower than yields for the conventional, spring-plow tillage system at both locations; thus, the spring-plow wheat system resulted in higher water use efficiencies. Grain yields in the alternate spring wheat-fallow rotation were similar to continuous wheat at one location. Thus, on a land-use basis, yields of wheat grown on fallow were half the yields of continuous wheat and 1 bushel/acre less per inch of water when water lost during the fallow counterpart was considered. Fallow wheat yields at the other location were 14 bushels/acre higher than continuous wheat yields. However, on a land-use basis, yields of wheat planted after fallow were 8 bushels/acre less than continuous wheat yields. Continuous wheat did not make use of 12% to 24% of the precipitation received; fallow wheat did not make use of 67% to 75% of the precipitation received. (Doria-PTT)
W88-03210

OPTIMAL ALLOCATION AND SCHEDULING OF IRRIGATION WATER FOR COTTON AND SOYBEANS,
Arkansas Univ., Fayetteville. Dept. of Agricultural Economics and Rural Sociology.
M. J. Cochran, L. Parsch, J. M. Redfern, and H. D. Scott.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-160851/AS. Price codes: A04 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville. AWRRC Publication No. 116, September 1985. 54 p, 2 fig, 15 tab, 26 ref. Contract No. 14-08-0001-G893. Project No. USGS G893-04.

Descriptors: *Cotton, *Soybeans, *Optimal allocation, *Irrigation scheduling, *Arkansas, Irrigation practices, Computer models, Stochastic models, Irrigation water, Alternative water use.

This study evaluated alternative irrigation scheduling strategies for cotton and soybean production on Sharkey clay soils in southeast Arkansas. Strategies were ranked on the basis of two basic criteria: expected net revenue and risk efficiency. Risk efficiency was defined for different risk preferences using stochastic dominance techniques. Preferred strategies for cotton employed tensiometer thresholds between-.45 atm and -.75 atm. Risk efficient soybean irrigation strategies varied with the degree of risk aversion--more risk averse decision-makers prefer strategies with lower thresholds. (Cochran-WRRC-University of Arkansas, Fayetteville)
W88-03490

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

STUDY OF A NATURALLY OCCURRING HYDRILLA INHIBITOR,
University of South Florida, Tampa. Chemical and Environmental Management Center.
D. F. Martin.
Available from the National Technical Information Service, Springfield, VA 22161, as ADA-129105, A03 in paper copy, A01 in microfiche. Miscellaneous paper A-83-2, March 1983. Final Report. U.S. Army Aquatic Plant Control Research Program, Army Engineer Waterways Experiment Station, Vicksburg, MS. 36 p, 11 fig, 6 tab, 13 ref. Contract No. DACW39-80-C-0066.

Descriptors: *Weed control, *Aquatic weed control, *Inhibition, *Hydrilla, Sediment, Lake Starvation, Florida, Metals, Lake sediments, Humic acid, Organic compounds, Chlamydomonas.

An investigation was made of sediment from Lake Starvation (northwest Hillsborough County, Florida) where hydrilla, though present, has not spread during a 10-year period. The sediment was treated with water, autoclaved, and the aqueous extracts separated into molecular weight fractions by ultrafiltration. One fraction, thus obtained, inhibited the growth of hydrilla by 30%, as measured by the weight increase, relative to control samples. The active fraction was characterized by inorganic and organic content as well as trace metal content (iron, manganese, nickel, and cadmium). Subsequently, the active fraction was separated further using high-performance liquid chromatography, and the components thus separated were characterized by ultraviolet adsorption spectra and by their effect on the size distribution of Chlamydomonas reinhardii. One component that showed significant bioactivity according to this assay was subjected to mass spectrometry. The maximum molecular ion for this component was less than 500. The available evidence is consistent with an aromatic molecule that contains a carboxylic acid. Further evidence includes the infrared spectra and the observation that all activity was lost when the sample was passed over an anion-exchange resin, whereas no activity was lost when the sample was passed over a cation-exchange resin. (Author's abstract)
W88-02918

WHITE AMUR BIBLIOGRAPHY,
Florida Univ., Gainesville. Center for Aquatic Weeds.
C. R. Smith, and J. V. Shirement.
Available from the National Technical Information Service, Springfield, VA 22161. Miscellaneous paper A-83-7, August 1983. Final Report. U.S. Army Aquatic Plant Control Research Program, Army Engineer Waterways Experiment Station, Vicksburg, MS. 183 p, 11 tab, 2 append, 828 ref. Contract No. DACW39-80-C-0035.

Descriptors: *Weed control, *Biocontrol, *Aquatic weed control, *Fish, *Literature reviews, White amur, Grass carp, Water hyacinth, Hydrilla, Food habits, Aquaculture, Ecological effects, Environmental effects, Fish establishment, Fish diseases, Fish farming, Growth, Fish physiology, Fish ponds, Fish populations, Fish stocking, Fisheries, Ponds, Channel improvement.

A literature review of the white amur (also known as the grass carp), an herbivorous fish, covers its nomenclature, morphology, anatomy, histology, cytology, distribution, environmental tolerance, reproduction, development from egg fertilization to adulthood, food and feeding habits, growth, interaction with predators and parasites, competition with other species, population dynamics, fisheries, aquaculture, transplantation, manipulated reproduction, and role in weed control. This fish is a viable weed control measure in small ponds used for culture and in reservoirs, lakes, canals, rivers, rice fields, powerplant cooling reservoirs, and sewage plant effluent ponds. They have been used in conjunction with other aquatic weed control measures: mottled water hyacinth weevil, retarded water hyacinth, herbicides, and hand weed removal. Efficiency of weed control and environmental impacts of this fish are reported in many studies. Some countries and many states regulate the introduction of the white amur. (Cassar-PTT)
W88-02919

IMPACT OF AUGMENTED FIELD POPULATIONS OF ARZAMA DENSA LARVAE ON WATERHYACINTH,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
A. F. Cofrancesco.
Available from the National Technical Information Service, Springfield, VA 22161as ADA-125007, A02 in paper copy, A01 in microfiche. Miscellaneous paper A-82-8, December 1982. Final Report. 22 p, 12 fig, 5 tab, 4 ref.

Descriptors: *Aquatic weed control, *Water hyacinth, *Biological control, *Arzama densa, Aquatic plants, Aquatic weeds, Biocontrol, Insects.

This research was conducted to evaluate the use of Arzama densa as a biological agent for the management of waterhyacinth. Third instar larvae were released at different rates, and their impact was monitored over a 4-month period. Based on results obtained in this study, the following conclusions have been drawn: (1) Although A. densa larvae applied at a ratio of one larvae per six plants produced measurable reductions in plant biomass, this treatment rate did not produce a significant change in the surface coverage of waterhyacinth on treated sites; (2) The release of a large number of A. densa larvae on waterhyacinth populations does not ensure that an increase in the population of A. densa will occur in subsequent generations; and (3) Modifications of the application procedure of A. densa will be necessary to achieve the desired level of waterhyacinth control. (Lantz-PTT)
W88-02925

EVALUATION OF A FORMULATION OF CERCOSPORA RODMANII FOR INFECTIVITY AND PATHOGENICITY OF WATERHYACINTH,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
E. A. Theriot, R. F. Theriot, and D. R. Sanders.
Available from the National Technical Information Service, Springfield, VA 22161as ADA-102051, A03 in paper copy, A01 in microfiche. Technical Report A-81-5, June 1981. Final Report. 42 p, 19

fig, 11 tab, 12 ref.

Descriptors: *Aquatic weed control, *Weed control, *Biocontrol, Pathogenic fungi, Water hyacinth, Cercospora rodmanii, Fungi, Aquatic plants, Louisiana.

A formulation of the fungal pathogen Cercospora rodmanii was preliminarily evaluated to determine application rates required to achieve adequate infection of water hyacinth under environmental conditions normally found in Louisiana. Application rates were as follows: spring study, 1 million viable propagules at 0, 5, 10, and 20 g/sq m; fall study, 4 million viable propagules at 0, 1, 2.5, and 10 g/sq m. In both studies significant secondary infection of water hyacinth tissues was observed on new leaves of original plants and on daughter plants. The recommended application rates for C. rodmanii were 5 million viable propagules per sq m in the spring treatment and 4 million viable propagules per sq m in the fall treatment. (Cassar-PTT)
W88-02930

LARGE-SCALE OPERATIONS MANAGEMENT TEST OF USE OF THE WHITE AMUR FOR CONTROL OF PROBLEM AQUATIC PLANTS, REPORT 2: FIRST YEAR POSTSTOCKING RESULTS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
E. C. Blancher, and C. R. Fellows.
Volume IV: Nitrogen and Phosphorus Dynamics of the Lake Conway Ecosystem: Loading Budgets and a Dynamic Hydrologic Phosphorus Model, Technical Report A-78-2, August 1982. Report 2 of a Series. Army Engineer Waterways Experiment Station, Vicksburg, MS. 60 p, 8 fig, 10 tab, 50 ref, 2 append. Contract No. DACW39-76-C-0076-002.

Descriptors: *Water pollution sources, *Nutrients, *Phosphorous, *Nitrogen, *Lakes, Aquatic weed control, Aquatic plants, Weed control, White amur, Grass carp, Lake Conway, Florida, Hydrologic budget, Model studies, Sediments, Lake sediments, Urban runoff, Runoff, Seepage.

An integrated nutrient budget for Lake Conway, Florida, was developed that integrated physical, chemical, and biological relationships. A hydrologic budget was constructed from measurements of storm water runoff, subsurface seepage flows, and existing precipitation and evaporation data. It was determined that major sources of external nitrogen and phosphorous loadings (total, 2.53 g nitrogen/sq m-year and 0.224 g phosphorous/sq m-year) were from atmospheric loadings, urban runoff, and subsurface seepage. Based on a simulation model of the phosphorous dynamics of Lake Conway, it was concluded that sedimentation of phosphorous was occurring at higher than predicted rates, nutrient release by submerged macrophytes was salient to phosphorous dynamics, and release of phosphorous by sediments was not a significant internal source of this nutrient. (Author's abstract)
W88-02931

LOW-FLOW FREQUENCY ANALYSES FOR STREAMS IN WEST-CENTRAL FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-02979

DRAINAGE-AREA DATA FOR WISCONSIN STREAMS,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03082

FLOODS IN SOUTH-CENTRAL IOWA,
Geological Survey, Iowa City, IA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03132

DEVELOPMENT OF GENERAL GUIDELINES FOR THE PLANNING OF STORMWATER MANAGEMENT FACILITIES: APPLICATION TO URBAN WATERSHEDS IN KENTUCKY,
Kentucky Water Resources Research Inst., Lexington.
L. E. Ormsbee, and V. T. Reinert.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-168069/AS. Price codes: A05 in paper copy, A01 in microfiche. Research Report No. 157. August 1985. 86 p, 13 tab, 23 fig, 29 ref. Contract No. 14-08-0001-G-908. Project No. USGS G908-05.

Descriptors: *Urban watersheds, *Storm water, *Urban runoff, *Detention reservoirs, *Design criteria, *Kentucky, Planning.

A planning methodology and a design tool is provided to help determine the appropriate location and volume of detention basins required to control critical storm events. The technique involves using watershed characteristics including the SCS curve number, time of concentration, peak outflow rate, watershed area and the storage recurrence interval to help predict these detention volumes. Historical rainfall records are used in a revised continuous simulation program (SYNOP, Hydroscience, Inc.) to determine the rainfall excess from which runoff hydrographs are produced. Various combinations of the watershed characteristics were input and computer analyses done to obtain the required data base. A statistical analysis is performed in each computer analysis to obtain the statistics on the required volume. Graphs were drawn from these statistical results as functions of the watershed characteristics and the release rate. Entering the graphs with the governing watershed characteristics, the designer can obtain a good estimate of the detention basin volume required. (Huffsey-U. KY. WRRI)
W88-03176

APPLICATION OF THE PRINCIPLE OF MAXIMUM ENTROPY (POME) TO HYDROLOGIC FREQUENCY ANALYSIS,
Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W88-03181

ANALYSIS AND GENERATION OF LOW FLOW SEQUENCES FOR IDAHO STREAMS USING DISAGGREGATION MODELING,
Idaho Univ., Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 2E.
W88-03189

WATER RESOURCES PLANNING USING INTEGRATED SYSTEMS OF MARKETABLE WATER RIGHTS AND RESERVOIR DESIGN AND OPERATION,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W88-03191

SUPPLEMENT TO INVENTORY AND ANALYSES OF INFORMATION FOR FLOOD PLAIN MANAGEMENT IN NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03299

STREAMFLOW STATISTICS AND DRAINAGE BASIN CHARACTERISTICS FOR THE SOUTHWESTERN AND EASTERN REGIONS, WASHINGTON, VOLUME I. SOUTHWESTERN WASHINGTON; VOLUME II. EASTERN WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03301

ANALYSIS OF FLOOD-FLOW FREQUENCY FOR SELECTED GAGING STATIONS IN SOUTH DAKOTA THROUGH SEPTEMBER 1985,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03303

ESTIMATING AVERAGE BASE FLOW AT LOW-FLOW PARTIAL-RECORD STATIONS ON SOUTH-SHORE STREAMS OF LONG ISLAND, NEW YORK,
Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03312

METHODS FOR ESTIMATING LOW-FLOW STATISTICS FOR UNGAGED STREAMS IN THE LOWER HUDSON RIVER BASIN, NY,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03343

HYDROLOGIC DESCRIPTION OF THE TAMARACK WILDLIFE AREA AND VICINITY, LOGAN COUNTY, COLORADO, AND SIMULATED EFFECTS OF POSSIBLE WATER-MANAGEMENT ACTIVITIES,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03355

PRELIMINARY EVALUATION OF REGRESSION EQUATIONS FOR PREDICTING MAGNITUDE AND FREQUENCY OF FLOOD PEAKS IN SELECTED SMALL DRAINAGE BASINS IN OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03380

FLOODS OF JUNE-JULY 1982, IN IOWA,
Geological Survey, Iowa City, IA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03390

FLOODS IN THE FLOYD RIVER BASIN, IOWA,
Geological Survey, Iowa City, IA. Water Resources Div.
A. J. Heinitz.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-476, 1986. 18 p, 15 fig, 4 tab, 8 ref, 4 append.

Descriptors: *Floods, *Iowa, *Surface runoff, *Historic floods, River flow, Hydrology, Water resources development, Flooding.

Flood elevation profiles and flood peak discharges for the floods of 1953, 1962, 1973, and 1983 in the Floyd River basin are given in this report. The profiles cover the Floyd and West Branch Floyd Rivers. The 1953 flood is the greatest known on the Floyd River since at least 1892. (USGS)
W88-03391

INVENTORY OF INTERBASIN TRANSFERS OF WATER IN THE WESTERN CONTERMINOUS UNITED STATES,
Geological Survey, Lakewood, CO. Water Resources Div.
H. E. Petsch.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-166, 1985. 45 p, 2 fig, 6 tab, 9 ref.

Descriptors: *Water transfer, *Diversions, *Water conveyance, *Inter-basin transfers, *Water exports,

Canals, Tunnels, Ditches, Pipelines, Conduits, Aqueducts, Water resources.

Information is presented on the quantity of water transferred from one river basin to another in the western conterminous United States. The information is needed by water system managers and planners to develop water budgets for major river basins, to examine the relative extent of existing interbasin transfers, and to define the importance of transferring water to meet regional water demands. All or parts of 11 major water resources regions and 111 complete subregions comprise the study area; water is exported from 39 of these subregions. The average quantity of water exported annually during 1973-82 was about 12 million acre-feet. (USGS)
W88-03394

FLOOD OF SEPTEMBER 12-13, 1982 IN GIBSON, CARROLL, AND MADISON COUNTIES, WEST TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03423

LOW FLOWS AND FLOW DURATION OF TENNESSEE STREAMS THROUGH 1981,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03471

4B. Groundwater Management

BEHAVIOR OF ORGANIC POLLUTANTS IN PRETREATED RHINE WATER DURING DUNE INFILTRATION,
Rijksinstituut voor de Volksgezondheid en Milieuhygiene, Leidschendam (Netherlands).
For primary bibliographic entry see Field 5B.
W88-02540

PARAMETER ESTIMATION IN GROUNDWATER: CLASSICAL, BAYESIAN, AND DETERMINISTIC ASSUMPTIONS AND THEIR IMPACT ON MANAGEMENT POLICIES,
Wright State Univ., Dayton, OH.
H. A. Loaiciga, and M. A. Marino.
Water Resources Research WRERAQ, Vol. 23, No. 6, p 1027-1035, June 1987. 2 fig, 16 ref, append.

Descriptors: *Groundwater management, *Groundwater, *Model studies, *Parametric hydrology, *Parameter uncertainty, *Data interpretation, Distribution assumptions, Mathematical studies, Mathematical equations, Management planning, Decision making, Statistical methods.

A theoretical analysis of parameter uncertainty in groundwater management models was presented. The importance of adopting classical, Bayesian, or deterministic distribution assumptions on parameters is examined from a mathematic standpoint. In the classical case, the parameters (e.g., hydraulic conductivities or storativities) are assumed fixed (i.e., nonrandom) but unknown. The Bayesian assumption considers the parameters as random entities with some probability distribution. The deterministic case, also called certainty equivalence, assumes that the parameters are fixed and known. Previous work on the inverse problem has emphasized the numerical solution for parameter estimates for subsequent use in the simulation of field variables. Now, the role of parameter uncertainty (measured by their statistical variability) in groundwater management decisions is investigated. It is shown that the classical, Bayesian, and deterministic assumptions lead to analytically different management solutions. Numerically, the difference between such solutions depends upon the covariance of the parameter estimates. The theoretical analyses showed the importance of specifying the proper distributional assumption on groundwater parameters, as well as the need for using efficient and statistically consistent methods to solve the inverse problem. The distributional assumptions on groundwater parameters and the covariance of their sample estimators are shown to be the dominant parameter uncertainty factors affecting groundwater management solutions. An example illustrates the conceptual findings. (Author's abstract)
W88-02780

GROUND WATER AND ENERGY: REPORT OF THE U.S. DEPARTMENT OF ENERGY'S NATIONAL WORKSHOP, JANUARY 29-31, 1980, ALBUQUERQUE, NEW MEXICO.
Department of Energy, Washington, DC. Div. of Environmental Impacts.
For primary bibliographic entry see Field 6D.
W88-02948

GROUND-WATER SYSTEM IN THE LA GRANGE AQUIFER NEAR LA GRANGE, SOUTHEASTERN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-02970

HYDROGEOLOGY OF THE SULPHUR SPRINGS AREA, TAMPA, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-02999

TRENDS IN MUNICIPAL-WELL INSTALLATIONS AND AQUIFER UTILIZATION IN SOUTHEASTERN MINNESOTA, 1880-1980,
Geological Survey, St. Paul, MN. Water Resources Div.
D. G. Woodward.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 83-4222, 1985. 99 p, 17 fig, 6 tab, 45 ref.

Descriptors: *Water supply, *Groundwater availability, *Minnesota, Aquifer management, Water wells, Hollandale embayment, Northern Midwest RASA study, Municipal water supply.

Water distributed by municipal systems has been the largest use of water in southeastern Minnesota for the past 100 years. By 1980, groundwater supplied 294 of the 309 municipal systems in the area. The development of groundwater supplies for municipal use began around the 1880's as an alternative to supplies from lakes and rivers. After about 4,500 Minnesotans died in typhoid epidemics from 1881 to 1900, deep wells became widely used to avoid comtaminated surface water. An inventory of 1,244 wells drilled for municipal systems from 1880 to 1980 has been completed. Of the five bedrock aquifers in the area, the Prairie du Chien-Jordan is the most extensively used with 537 municipal wells tapping it. Aquifer preference was analyzed to determine whether municipal wells were completed in the shallowest bedrock aquifer present in an area, in a deeper bedrock aquifer, or in a drift aquifer above the bedrock. Maps show the location of municipal wells and the aquifers in which they are completed for five time periods along with temporal aquifer preferences. The 1,244-well inventory lists the municipality, year well drilled, well depth, and aquifer completion by county. (USGS)
W88-03042

POTENTIOMETRIC SURFACES OF NOVEMBER 1982 AND DECLINES IN THE POTENTIOMETRIC SURFACES BETWEEN THE PERIOD PRIOR TO DEVELOPMENT AND NOVEMBER 1982 FOR THE COASTAL PLAIN AQUIFERS OF SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03056

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE BATH AREA, LOWER COHOCTON RIVER, STEUBEN COUNTY, NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03060

APPROXIMATE WATER-LEVEL CHANGES IN THE CHICOT AND EVANGELINE AQUIFERS, 1977-85 AND 1984-1985 AND MEASURED COMPACTION, 1973-85, IN HARRIS AND GALVESTON COUNTIES, TEXAS,
Geological Survey, Houston, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03080

WATER-LEVEL MEASUREMENTS FOR THE COASTAL PLAIN AQUIFERS OF SOUTH CAROLINA PRIOR TO DEVELOPMENT,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03090

HYDROGEOLOGIC FRAMEWORK OF THE NEW JERSEY COASTAL PLAIN,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03093

HYDROLOGY OF THE FLORIDAN AQUIFER SYSTEM IN WEST-CENTRAL FLORIDA,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03111

DISCRETE KERNEL MODEL FOR SIMULATION OF MULTILAYERED AQUIFERS,
Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W88-03179

BASE LINE DATA ANALYSIS OF A DEVELOPING GEOTHERMAL SYSTEM, BOISE, IDAHO,
Boise State Univ., ID. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2F.
W88-03190

TECHNIQUE FOR PREDICTING GROUNDWATER DISCHARGE TO SURFACE COAL MINES AND RESULTING CHANGES IN HEAD,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03333

JANUARY 1985 WATER LEVELS, AND DATA RELATED TO WATER-LEVEL CHANGES, WESTERN AND SOUTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03387

SUMMARY OF MUNICIPAL PUMPAGE FOR THE FRESNO AREA, CALIFORNIA, 1931-80,
Geological Survey, Sacramento, CA. Water Resources Div.
J. R. Guay, and H. T. Mitten.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-492, 1986. 21 p, 3 fig, 4 tab.

Descriptors: *Pumpage, *Groundwater depletion, *Water use, *California, *San Joaquin Valley, Well data, Fresno, Clovis, Water levels, Water yield, Maps.

Municipal pumpage data for 1931-80 is summarized for the Fresno area, California. Pumpage data for 269 wells were compiled for the cities of Fresno and Clovis, Fresno County, and other nearby water districts. Municipal pumpage for wells in the city of Fresno increased from 7,690 million in 1931 to 23,924 million gallons in 1980. The data will be used by Fresno County to assist in the development of water management plan for the Fresno area. (USGS)
W88-03393

WATER RESOURCES OF HUGHES COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03420

DELINEATION AND DESCRIPTION OF THE REGIONAL AQUIFER SYSTEMS OF TENNESSEE--THE CUMBERLAND PLATEAU AQUIFER SYSTEM,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03424

DELINEATION AND DESCRIPTION OF THE REGIONAL AQUIFER SYSTEMS OF TENNESSEE--THE KNOX AQUIFER,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03426

DELINEATION AND DESCRIPTION OF THE REGIONAL AQUIFER SYSTEMS OF TENNESSEE--THE EAST TENNESSEE AQUIFER SYSTEM,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03430

DELINEATION AND DESCRIPTION OF THE REGIONAL AQUIFER SYSTEM OF TENNESSEE--THE CRETACEOUS AQUIFER SYSTEM,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03432

DELINEATION AND DESCRIPTION OF THE REGIONAL AQUIFER SYSTEMS OF TENNESSEE--THE HIGHLAND RIM AQUIFER SYSTEM,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03433

DELINEATION AND DESCRIPTION OF THE REGIONAL AQUIFER SYSTEMS OF TENNESSEE--THE TERTIARY AQUIFER SYSTEM,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03434

DELINEATION AND DESCRIPTION OF THE REGIONAL AQUIFER SYSTEMS OF TENNESSEE--THE CENTRAL BASIN AQUIFER SYSTEM,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03435

APPLICATION OF A LAYERED GROUNDWATER MODEL TO CRITICAL AREAS IN NORTHEAST MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W88-03483

4C. Effects On Water Of Man's Non-Water Activities

IMPACT OF URBANIZATION ON MAJOR ION FLUX THROUGH CATCHMENTS: A CASE STUDY IN SOUTHERN ENGLAND,
Southern Illinois Univ., Carbondale. Dept. of Geography.
C. W. Prowse.
Water, Air, and Soil Pollution WAPLAC, Vol. 32, No. 3/4, p 277-292, February 1987. 5 fig, 3 tab, 64 ref.

Descriptors: *Urbanization, *Catchment areas, *Weathering, *Soil erosion, *Urban hydrology, *Ion transport, *Cycling nutrients, Rainfall, Streams, Water analysis, Ions, Nutrients, Case studies, Denudation.

Although much is known about chemical denudation and nutrient cycling through catchments, little has been done to identify and explain changes in major ion flux upon urbanization. Fifty-two weekly samples of precipitation and stream waters were analyzed for 9 major ions totaling 95% of the total dissolved solids for a catchment in southern England. Net major ion export rates from the urban area are between 2 and 104 times those for the rural areas. This increase is attributed both to accelerated denudation and non-denudational anthropogenic sources. Estimates of both components indicate that between 50 and 60% of the dissolved ions removed from urban areas is non-denudational. This translates to possible increases in the chemical denudation rate of up to six-fold upon urbanization. (Author's abstract)
W88-02493

CHANGES IN FOREST FLOOR AND WATER QUALITY FOLLOWING THINNING AND CLEARCUTTING OF 20-YEAR-OLD PINE,
Southern Forest Experiment Station, Oxford, MS. Forest Hydrology Lab.
D. C. McClurkin, P. D. Duffy, and N. S. Nelson.
Journal of Environmental Quality JEVQAA, Vol. 16, No. 3, p 237-241, July-September 1987. 2 fig, 3 tab, 12 ref.

Descriptors: *Forests, *Water quality, *Clear-cutting, *Pine trees, *Runoff, *Land clearing, *Soil erosion, Sediments, Lysimeters, Rainfall, Nutrients.

Effects of timber cutting on forest floor, sediment movement, and chemical quality of percolating water and of plot runoff are reported for pole-size loblolly pine (Pinus taeda L.) plantations on fragile soils of the upper Coastal Plain. Treatments were clearcut, thin, and no cut. Water quality measurements were derived for runoff samples from 0.002-ha plots and for percolating water from zero-tension lysimeters at a 15-cm depth. Forest floor on clearcut plots was reduced to near the minimum regarded as necessary for site protection within two years. Regardless of cutting treatment, more N and P were coming into the plots via precipitation than were leaving via plot runoff and percolation combined. More K appeared to be leaving the sites than was coming in via rainfall, regardless of cutting treatment. Sediment concentrations in plot runoff tended to be proportional to cutting intensity. Nutrient content in percolation waters was unrelated to cutting intensity. Nutrient concentrations in plot runoff were high compared to concentrations reported in stormflows from local, small catchments with similar characteristics, but plot runoff was <3% of annual rainfall. (Author's abstract)
W88-02720

REQUIREMENTS ON THE HANDLING OF CHEMICALS AND WASTES REGARDING SOIL AND GROUNDWATER PROTECTION,
Umweltbundesamt, Berlin (Germany, F.R.).
H.-P. Luhr.
Ecotoxicology and Environmental Safety EESADV, Vol. 13, No. 3, p 282-289, June 1987. 3 fig, 3 ref.

Descriptors: *Waste disposal, *Technology, *Hazardous wastes, *Groundwater, *Pollution effects, *Water pollution effects, *Environmental effects, *Ecological effects, *Water pollution prevention, Organic compounds, Inorganic compounds, Ecology.

It was and still is naive to believe that we can discharge uncontrolled tons and tons of intentionally and unintentionally produced substances into the environment without any reactions of the environment. Forests are dying, damages to buildings are becoming visible, drinking water, an essential food, is in danger, and whole species of animals and plants are dying out. Along with technical development, the number of potential hazards has increased considerably during the past 200 years. But dangers such as death, suffering, and losses of material goods and of the quality of life occurring at all times are not new. New is the extent of potential effects exceeding all experience and our imagination, inter alia with a view to long-term effects emanating from substances/products. Contaminated sites, including waste dumps and polluted industrial sites, are typical and sad characteristics of industrial societies all over the world. This phenomenon is the result of treating production and waste disposal separately. In all sectors technical systems are applied and should be subject to the requirement that uncontrolled transitions of substances into the environment should be avoided. Because of the disposal policy practiced so far, i.e., 'to throw millions of tons of waste products into holes open to all sides,' the pressure for a change in waste disposal can have effect only if the 'holes where wastes can simply be dumped' no longer exist. Only thus can a shifting of the disposal process in the direction of the production process be reached; only thus can procedures be changed with the objective of reduceing or preventing the production of waste, and recycling potentials can be used. (Alexander-PTT)
W88-02727

HYDROLOGY OF LAKE CARROLL, HILLSBOROUGH COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 2H.
W88-02980

HYDROLOGY OF THE FERRON SANDSTONE AQUIFER AND EFFECTS OF PROPOSED SURFACE-COAL MINING IN CASTLE VALLEY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
G. C. Lines, and D. J. Morrissey.
Water-Supply Paper 21, 1983. 40 p, 25 fig, 7 tab, 43 ref.

Descriptors: *Aquifer characteristics, *Strip mines, *Dewatering, *Utah, *Groundwater availability, Mine drainage, Computer models, Mine hydrologic impact, Coal hydrology.

Groundwater in the Ferron Sandstone Member of the Mancos Shale of Cretaceous age is the source of supply for the town of Emery, but the aquifer is essentially untapped in other areas of Castle Valley in east-central Utah. Tests indicate that a well that would fully penetrate the aquifer near the Paradise Valley-Joes Valley fault system in the Emery area could be expected to produce 100 to 500 gallons per minute. In the northern two-thirds of Castle Valley, the aquifer probably would not yield more than about 10 gallons per minute to individual wells. Dissolved-solids concentration in Ferron water ranges from less than 500 to more than 20,000 milligrams per liter. Computations using a three-dimensional digital-computer model of the

Ferron sandstone aquifer indicate drawdowns greater than 5 feet in the potentiometric surface of the upper part of the aquifer, caused by dewatering of a proposed surface coal mine, and extending horizontally about 2.5 miles from the mine after 15 years of operation. Discharge from the proposed mine is predicted to average 0.3 cubic foot per second. If water from the proposed mine were discharged into Christiansen Wash, the base flow of the stream would increase dissolved-solids concentrations in the stream water would increase, and during some periods. With proper reclamation of mined lands and the use of sediment ponds, the sediment load of Christiansen Wash is not expected to increase significantly. (USGS)
W88-03000

HYDROLOGIC DATA FOR URBAN STUDIES IN THE HOUSTON, TEXAS, METROPOLITAN AREA, 1980,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03001

USE OF THE PAIRED-BASIN TECHNIQUE IN FLOW-RELATED WILDLAND WATER-QUALITY STUDIES,
Forest Service, Fort Collins, CO. Watershed Systems Development Group.
For primary bibliographic entry see Field 5B.
W88-03006

TEMPORAL CHANGES IN CHLORIDE, SULFATE, AND SODIUM CONCENTRATIONS IN FOUR EASTERN PENNSYLVANIA STREAMS,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03030

EFFECTS OF SURFACE COAL MINING ON SUSPENDED-SEDIMENT DISCHARGE, IN A SMALL MOUNTAIN WATERSHED, FAYETTE COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
T. M. Mastrilli, and D. E. Stump.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4093, 1986. 20 p, 12 fig, 5 tab, 13 ref.

Descriptors: *Streamflow, *Suspended sediments, *Coal mining effects, *Sediment load, *Pennsylvania, Runoff, Erosion, Fayette County.

Data collected in the upper Stony Fork basin from July 1980 to November 1981 indicate that logging operations associated with block-cut surface mining temporarily increased suspended-sediment discharge of Stony Fork. However, the strip-mining operation did not increase the suspended sediment discharges of Stony Fork because of effective sediment-control measures. These controls included diversion control terraces and a large sediment-control pond. The 50-acre mine site yielded an average of 6.9 tons of sediment per acre, whereas, the sediment yield of the 2.5-square-mile study area was 0.13 tons per acre. During most storms, sharp rises in streamflow were accompanied by corresponding rises in suspended sediment concentrations. At the end of a storm, suspended sediment concentrations quickly returned to base-flow levels. Instantaneous stream discharge ranged from 0.02 to 146 cubic feet per second. Suspended sediment concentration ranged from less than 10 to 905 milligrams per liter. The highest daily mean suspended sediment concentration was 176 milligrams per liter. (USGS)
W88-03031

EFFECTS OF URBAN DEVELOPMENT OF HYDROLOGY OF THE REEDY CREEK IMPROVEMENT DISTRICT, CENTRAL FLORIDA,
Geological Survey, Orlando, FL. Water Resources Div.
E. R. German.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4250, 1986. 109 p, 28 fig, 13 tab, 17 ref.

Descriptors: *Urbanization, *Hydrologic aspects, *Water quality, *Surface water, *Groundwater, *Lakes, *Environmental effects, *Florida, Walt Disney World, Reedy Creek Improvement District.

The Reedy Creek Improvement is an area of about 43 square miles in southwestern Orange and northwestern Osceola Counties, Florida. A systematic program of hydrologic data collection in the Reedy Creek Improvement District and vicinity provided data for assessing the impact of development, mostly the Walt Disney World Theme Park and related development on the hydrology. Data collected include stream discharge, water quality, groundwater levels, lakes levels, and climatological. Rainfall has been less than the long-term average in the Reedy Creek Improvement District since development began in 1968. The deficient rainfall has reduced stream discharge, lowered groundwater and lake levels, and possibly affected water quality in the area. Groundwater levels and lake levels have declined since 1970. However, the coincidence of below-average rainfall with the period of development makes it impossible to assess the effect of pumping on declines. Occurrence of toxic metals does not relate to development, but distribution of insecticides and herbicides does appear to relate to development. Specific conductance, phosphorous, and nitrate concentrations have increased in Reedy Creek since 1970, probably due to disposal of treated wastes. (USGS)
W88-03034

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE LITTLE BEAR CREEK AREA, MOORHEAD COAL FIELD, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
N. E. McClymonds.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4201, 1986, 91 p, 12 fig, 10 tab, 31 ref.

Descriptors: *Coal mines, *Coal mining effects, *Montana, *Powder River Basin, Hydrology, Reclamation.

The Little Bear Creek area of the Moorhead Coal Field, 27 miles south of Ashland, Montana, contains large reserves of Federally owned coal that have been identified for potential lease sale. A hydrologic study was conducted in the area to describe existing hydrologic system and to assess potential effects of surface mining on local water resources. Hydrologic data collected from private wells, observation wells, test holes and springs indicate that the aquifers are coal and sandstone beds in the upper part of the Tongue River Member, Fort Union Formation (Paleocene age), and sand and gravel layers of valley alluvium (Pleistocene and Holocene age). Surface water is available from ephemeral flow along stretches of the main streams, and from stock ponds throughout the area. Mining the Anderson and Dietz coal beds would destroy one stock well and several stock ponds, would possibly interfere with the flow of one spring, and would lower the potentiometric surface within the coal and sandstone aquifers. The alluvial aquifer beneath Little Bear Creek and Davidson Draw would be removed at the mine site, as would sandstone and coal aquifers above the mine floor. Although mining would alter existing hydrologic systems, alternative water supplies are available. Planned structuring of the spoils and reconstruction of the alluvial aquifers could minimize downstream water-quality degradation. (USGS)
W88-03049

PROGRESS REPORT ON BLACK MESA MONITORING PROGRAM--1985-86,
Geological Survey, Flagstaff, AZ. Water Resources Div.
G. W. Hill, and M. I. Whetten.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-414, 1986. 23 p, 4 fig, 8 tab, 5 ref.

Descriptors: *Groundwater, *Water levels, *Water quality, *Monitoring, *Coal mining effects, *Arizona, Black Mesa, Navajo Indian Reservation, Hopi Indian Reservation, N aquifer.

The N aquifer is an important source of water in the 5,400 square-mile Black Mesa area on the Navajo and Hopi Indian Reservations, Arizona. The Black Mesa monitoring program is designed to monitor long-term effects on the groundwater resources of the mesa as part of withdrawals from the aquifer by the strip-mining operation of Peabody Coal Co. Withdrawals from the N aquifer by the mine increased from 95 acre-feet in 1968 to more than 4,000 acre-feet in 1984. In 1985, withdrawals from the mine wells were temporarily reduced to about 2,500 acre-feet. Water levels in the confined area of the aquifer declined as much as 87 feet from 1965 to 1985 in some municipal and observation wells within about a 15-mile radius of the mine well field. In 1986, measurements indicated some recovery in water levels in most of these wells because of an approximate 90-percent reduction in pumpage from Peabody Coal Co. wells during the last half of 1985. Part of the drawdown in municipal wells is due to local pumpage. Water levels have not declined in wells tapping the unconfined area of the aquifer. Chemical analyses indicate no significant changes in the quality of water from wells that tap the N aquifer or from springs that discharge from several stratigraphic units, including the N aquifer, since pumping began at the mine. (USGS)
W88-03074

ANALYSIS OF WETLAND TRENDS AND MANAGEMENT ALTERNATIVES FOR GEORGIA,
Georgia Univ., Athens. Inst. of Natural Resources.
S. W. Woolf, and J. E. Kundell.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-164159/AS. Price codes: A08 in paper copy, A01 in microfiche. Report No. ERC 01-85. Environmental Resources Center, Georgia Institute of Technology, Atlanta. August 1985. 154 p, 1 tab, 1 fig, 30 ref. Project No. USGS G-900-05.

Descriptors: *Coastal marshes, *Georgia, *Land use, *Salt marshes, *Wetlands, *Alternative planning, Drainage, Erosion, Estuaries, Flood control, Forest management, Marshes, Soils, Urban runoff, Vegetation, Water management, Waterfowl.

Georgia is experiencing 'Sunbelt' population growth and expansions in agricultural and forestry production resulting in increased pressure to convert wetlands to other uses. An analysis was undertaken of data generated by the Fish & Wildlife Service's National Wetland Inventory, Georgia Department of Natural Resource's Landsat Land use study, and Soil Conservation Service's National Resources Inventory. Wetland acreage, distribution, types, and trends were identified for Georgia. A review of case law and statutory law was conducted and wetland management activities of federal, state, and local governments were determined. Alternative management strategies were identified for Georgia. (Woolf-U. GA)
W88-03155

HYDROLOGY OF AREA 21, EASTERN COAL PROVINCE, TENNESSEE, ALABAMA, AND GEORGIA,
Geological Survey, Nashville, TN. Water Resources Div.
V. J. May.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 82-679, 1983. 92 p, 67 fig, 17 tab, 75 ref.

Descriptors: *Coal, *Strip mines, *Hydrologic aspects, *Eastern Coal Province, Water resources, Water quality, Surface waters, Subsurface waters, Cumberland Plateau, Tennessee, Georgia, Tennes-

see River basin, Elk River basin, Paint Rock River basin.

Area 21 is located in the southern part of the Eastern Coal province in south-central Tennessee and northeastern Alabama in the Tennessee River basin, and covers an area of 6,021 sq mi. Seventeen sites were established to collect additional streamflow and quality of water data in the coal-resources area in Area 21. Streamflow varies with time and basin, in a pattern similar to the seasonal variation in rainfall, due to differences in drainage basin size and other basin characteristics. The principal factors affecting the average annual flow of streams are rainfall and drainage basin size. Low flows vary widely across the area due primarily to the variation of geologic formations. Low flows in streams in the coal-resources area are generally less than for streams elsewhere. Most floods occur in the winter and spring, with about 73% occurring from December through March. Tae quality of surface waters sampled in Area 21 was generally good, with only small variations in most chemical constituents from site to site. Dissolved sulfate concentrations, usually indicative of mining activity, were generally low. Water at 75% of the sites had maximum concentrations less than 20 mg/L. The highest concentrations, ranging from 110 to 450 milligrams/L, were determined in Dry Creek near Fabius, Alabama, a stream draining part of the coal-resources area. Suspended-sediment loads are also indicative of surface mining activity. Comparison of mined versus unmined basins in the coal-resources area indicates suspended-sediment loads several times greater in streams draining mined basins. Groundwater quality is highly variable but suitable for most uses in most areas. Locally, especially in waters from Pennsylvania rocks and regolith, iron exceeds 300 micrograms/L and sulfate exceeds 250 milligrams/L, the recommended limits for drinking water. (USGS)
W88-03315

HYDROLOGY OF COAL-LEASE AREAS NEAR DURANGO, COLORADO,
Geological Survey, Grand Junction, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03321

PROGRESS REPORT ON THE EFFECTS OF HIGHWAY CONSTRUCTION ON SUSPENDED-SEDIMENT DISCHARGE IN THE COAL RIVER AND TRACE FORK, WEST VIRGINIA 1975-81,
Geological Survey, Charleston, WV. Water Resources Div.
S. C. Downs, and D. H. Appel.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4275, 1986. 20 p, 10 fig, 5 tab, 5 ref.

Descriptors: *Sediment discharge, *Suspended load, *Highway runoff, *Water pollution sources, *West Virginia, *Highway construction, Construction, Coal River basin, Trace Fork basin.

Construction of the four-lane Appalachian Corridon G highway disturbed about 2 sq mi in the Coal River and 0.35 sq mi of the 4.75 sq mi Trace Fork basin in southern West Virginia. Construction had a negligible effect on runoff and suspended-sediment load in the Coal River and its major tributaries, the Little Coal and Big Coal Rivers. Drainage areas of the mainstem sites in the Coal River basin ranged from 269 to 862 sq mi, and average annual suspended-sediment yields ranged from 535 to 614 tons/sq mi for the 1975-81 water years. Suspended-sediment load in the smaller Trace Fork basin (4.72 sq mi) was significantly affected by the highway construction. Based on data from undisturbed areas upstream from construction, the normal background load at Trace Fork downstream from construction during the period July 1980 to September 1981 was estimated to be 830 tons; the measured load was 2,385 tons. Runoff from the 0.35 sq mi area disturbed by highway construction transported approximately 1,550 tons of sediment. Suspended-sediment loads from the construction zone were also higher than normal background loads during storms. (USGS)
W88-03324

INVESTIGATION OF POSSIBLE EFFECTS OF SURFACE COAL MINING ON HYDROLOGY AND LANDSCAPE STABILITY IN PART OF THE POWDER RIVER STRUCTURAL BASIN, NORTHEASTERN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
R. M. Bloyd, P. B. Daddow, P. R. Jordon, and H. W. Lowham.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4329, 1986. 101 p, 38 fig, 22 tab, 63 ref.

Descriptors: *Coal mines, *Coal mining effects, *Model studies, *Simulation analysis, *Groundwater levels, *Surface water quality, Simulation models, Hydrology, Mathematical models, Wyoming, Powder River basin.

The effects of surface coal mining on the surface- and groundwater systems in a 5,400 sq mi area in the Powder River Basin, Wyoming, that includes 20 major coal mines were evaluated using three approaches: A surface water model, a landscape-stability analysis, and a groundwater model. A surface water model was developed for the Belle Fourche River basin. The Hydrological Simulation Program-Fortran model was used to simulate changes in streamflow and changes in dissolved-solids and sulfate concentrations. Simulated streamflows resulting from less than average rainfall were small, changes in flow from premining to during-mining and postmining conditions were less than 2.5%, and changes in mean dissolved-solids and sulfate concentrations ranged from 1 to 7%. A landscape-stability analysis resulted in regression relations to aid in the reconstruction of reclaimed drainage networks. Hypsometric analyses indicate the larger basins are relatively stable, and statistical data from these basins may be used to design the placement of material within a mined basin to approximate natural, stable landscapes in the area. The attempt to define and simulate the groundwater system in the area using a groundwater-flow model was unsuccessful. The steady-state groundwater-flow model could not be calibrated. The modeling effort failed principally because of insufficient quantity and quality of data to define the spatial distribution of aquifer properties; the hydraulic-head distribution within and between aquifers; and the rates of groundwater recharge and discharge, especially for steady-state conditions. (USGS)
W88-03325

RECONNAISSANCE OF THE WATER RESOURCES AND POTENTIAL EFFECTS OF MINING OF THE JOLIET-FROMBERG COAL TRACT, CARBON COUNTY, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
M. R. Cannon.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4155, 1986. 15 p, 4 fig, 3 tab, 9 ref.

Descriptors: *Hydrology, *Coal mining, *Mining effects, *Surface water, *Groundwater, *Montana, Carbon County.

The Joliet-Fromberg coal tract in Carbon County, Montana, contains subbituminous to bituminous coal suitable for underground mining. A reconnaissance study of the area was conducted to identify water resources of the coal tract and to determine general effects that underground mining could have on the water resources. Surface-water resources consist of Elbow Creek, a small perennial stream that drains most of the area, plus irrigation water diverted into the basin from Rock Creek and the Clarks Fork Yellowstone River. Groundwater resources consist of sandstone aquifers in several formations of Late Cretaceous age and alluvial aquifers of Pleistocene and Holocene age. Chemical analyses were made of water in Elbow Creek and water from seven wells in the area. Water from Elbow Creek is suitable for use by all livestock, based on the concentration of dissolved solids. Water from most sampled wells had dissolved-solids concentrations larger than the maximum (500 milligrams/L) recommended by the U.S. Environmental Protection Agency for public water supply. Effects of underground mining on water resources would be minimal. The Bridger coal bed in the Upper Cretaceous Eagle Sandstone has no significant hydraulic connection with Elbow Creek in most of the area and the Bridger coal bed does not appear to be a significant aquifer. Mining and dewatering of the coal could temporarily lower water levels in aquifers overlying the coal if mining causes subsidence and fracturing of rocks above the mine workings. (USGS)
W88-03345

HYDROGEOLOGY OF AND POTENTIAL MINING IMPACTS ON STRIPPABLE LIGNITE AREAS IN THE DENVER AQUIFER, EAST-CENTRAL COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03354

EFFECT OF URBANIZATION ON STREAMFLOW, SEDIMENT LOADS, AND CHANNEL MORPHOLOGY IN PHEASANT BRANCH BASIN NEAR MIDDLETON, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03357

SIMULATION OF MINE DRAINAGE FOR PRELIMINARY DEVELOPMENT OF OIL SHALE AND ASSOCIATED MINERALS, PICEANCE BASIN, NORTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
O. J. Taylor.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4011, 1986. 25 p, 14 fig, 2 tab, 12 ref.

Descriptors: *Oil shale, *Mine drainage, *Hydrologic models, *Model studies, *Piceance basin, Colorado.

The Piceance basin of northwestern Colorado contains large resources of oil shale, nahcolite, and dawsonite. Development of these minerals will require drainage of water from mines. A six-layer hydrologic model of the basin was prepared to simulate mine drainage for mineral development. Streams and major tributaries were simulated as head-dependent nodes. Stream nodes were gaining or losing, but the rate of loss was constrained by the leakance of the streambed and the stream stage. Springs also were simulated as head-dependent nodes that stop flowing if the aquifer head declines below the spring orifice. (USGS)
W88-03358

QUANTITY AND QUALITY OF URBAN STORM RUNOFF IN THE IRONDEQUOIT CREEK BASIN NEAR ROCHESTER, NEW YORK, PART 2,
Geological Survey, Ithaca, NY. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03363

SEDIMENT DISCHARGE DATA FOR THE LOWER REACH OF CAMPBELL CREEK, ANCHORAGE, ALASKA: MAY TO OCTOBER 1986,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 2J.
W88-03388

SIMULATED EFFECTS OF SURFACE COAL MINING AND AGRICULTURE ON DISSOLVED SOLIDS IN THE REDWATER RIVER, EAST CENTRAL MONTANA,

Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03419

EVALUATION OF THE PRECIPITATION-RUNOFF MODELING SYSTEM, BEAVER CREEK, KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03422

FLOODFLOW CHARACTERISTICS OF CURRENT RIVER AT ARKANSAS STATE HIGHWAY 328 NEAR REYNO, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03438

TRAP EFFICIENCY OF A SEDIMENT-CONTROL POND BELOW A BLOCK-CUT COAL MINE IN FAYETTE COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
L. A. Reed, L. Dilissio, and D. E. Stump.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4223, 1985. 16 p, 12 fig, 2 tab, 10 ref.

Descriptors: *Storm runoff, *Land use, *Sediments, *Pennsylvania, *Coal mining effects, Fayette County, Coal mines.

The U. S. Geological Survey determined the efficiency of a pond constructed to control sediment from a surface coal mine site by measuring runoff and sediment loads at the inlet to and discharge from the pond during storms. The pond is below a 17.9-acre block-cut coal mine in Fayette County, Pennsylvania and has a permanent pool capacity of 60,000 cu ft. The capacity at the principal spillway and the emergency spillway are 128,900 and 175,500 cu ft, respectively. The pond is equipped with a 3-inch flow control valve, used by the mine operator to regulate the pond stage between the permanent pool and the principal spillway. Data were collected during five moderate storms when the 3-inch control valve was intentionally opened. The ration between the quantity of water in the pond at the start of the storm and the quantity to runoff to the pond was calculated for each storm. The ratios were 3.6, 2.5, 8.6, 2.9, and 1.5 for the five storms. The measured trap efficiencies were 98.1, 92.8, 99.6, 99.1, and 98.2%, for the five storms. (USGS)
W88-03451

4D. Watershed Protection

ANALYTICAL SURVEY OF ACCUMULATIONS OF SEDIMENTS IN CANALS OF TOKYO PORT,
Bureau of Ports and Harbors, Tokyo (Japan).
For primary bibliographic entry see Field 2J.
W88-02530

SPECIAL APPLICATIONS AND CONCEPTS: SHORELINE NOURISHMENT--THE GULF ISLANDS NATIONAL SEASHORE EXPERIENCE,
National Park Service, Gulf Breeze, FL. Gulf Islands National Seashore.
For primary bibliographic entry see Field 5E.
W88-02581

SPECIAL APPLICATIONS AND CONCEPTS: BENEFITS OF UNDERWATER BERMS,
Corps of Engineers, Mobile, AL. Mobile District.
For primary bibliographic entry see Field 5E.
W88-02583

FIELD INSPECTION OF THE FISHER RIVER CHANNEL REALIGNMENT PROJECT NEAR LIBBY, MONTANA,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
M. P. Keown.
Inspection Report 11, April 1981. 25 p, 13 fig, 2 tab, 11 ref.

Descriptors: *Erosion control, *Protection, *Channel improvement, *Stream banks, *Groins, Fisher River, Libby, Montana, Riprap, Streambeds, Stream erosion, Bank erosion, Channel erosion, Fish habitats, Bank protection.

The Fisher River Channel Project, Montana, was inspected to evaluate the existing bank protection. In 1967 the channel had been realigned to accomodate the streambed and the relocated Great Northern Railroad east/west main line. Changes included shortening the 10.9 mile reach by 4815 ft and increasing the bed gradient through this reach from 34 to 37 ft/mile. To prevent channel degradation and mitigate impacts on the fish community, 67 rock groins had been placed through the 16 channel changes. Groin spacing was selected to provide a minimum pool depth of 1 ft between groins. Stone specifications were 20-2000 lb with 50% weighing over 1000 lb. Other erosion control measures were side slope riprap at railroad and road embankments and reseeding of disturbed areas. The most recent inspection (1979) showed that the project reach was stable; no serious channel degradation or aggradation was noted. Some groin rock was scattered downstream, but many groins were still intact. No riprap blankets on side slopes had failed. (Cassar-PTT)
W88-02941

NOTES ON SEDIMENTATION ACTIVITIES: CALENDAR YEAR 1984.
Geological Survey, Reston, VA. Office of Water Data Coordination.
September 1985. 219 p.

Descriptors: *Sedimentation, *Soil conservation, *Erosion, *Regional analysis, Soil management, Groundwater, Catchment areas, Surveys, Geologic erosion, Research priorities, Data collections, Sediment, Sediment transport, Suspended solids, Fluvial sediments.

A digest is presented of information furnished in 1984 by Federal agencies conducting sedimentation investigations. The Federal Interagency River Basin Committee's Subcommittee on Groundwater issues this report as a means of effecting better coordination of the work of various Federal agencies in the field of sedimentation. The report includes descriptions of work in progress or in the planning stages, as well as important findings, new methods, new publications, data relating to laboratory and research activities, and other pertinent information. The material is organized by major drainage regions in the conterminous United States, Alaska, Hawaii, and the Caribbean. The report also includes locations and addresses of the National Water Data Exchange assistance centers. Information for the present publication was contributed by the representatives of participating Federal agencies. (Geiger-PTT)
W88-02964

NOTES ON SEDIMENTATION ACTIVITIES: CALENDAR YEAR 1983.
Geological Survey, Reston, VA. Office of Water Data Coordination.
September 1984. 188 p.

Descriptors: *Sedimentation, *Soil conservation, *Erosion, *Regional analysis, Soil management, Groundwater, Catchment areas, Surveys, Geologic erosion, Research priorities, Data collections, Sediment, Sediment transport, Suspended solids, Fluvial solids.

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W88-02965

THEORY AND OPERATION MANUAL FOR THE AUTOPIPET, SEMI-AUTOMATIC PIPET WITHDRAWAL APPARATUS,
Geological Survey, Minneapolis, MN. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03007

DEVELOPMENT OF A BAG-TYPE SUSPENDED-SEDIMENT SAMPLER,
Geological Survey, Minneapolis, MN. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03008

DEVELOPMENT OF GENERAL GUIDELINES FOR THE PLANNING OF STORMWATER MANAGEMENT FACILITIES: APPLICATION TO URBAN WATERSHEDS IN KENTUCKY,
Kentucky Water Resources Research Inst., Lexington.
For primary bibliographic entry see Field 4A.
W88-03176

TRAP EFFICIENCY OF A SEDIMENT-CONTROL POND BELOW A BLOCK-CUT COAL MINE IN FAYETTE COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 4C.
W88-03451

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

BACTERIAL ANALYSIS OF CHROMOBACTERIUM SP. AND FLAVOBACTERIUM SP. IN A WASTE STABILIZATION POND SYSTEM,
Universidad Nacional Autonoma de Mexico, Mexico City.
F. Rivera, P. Bonilla, S. Soriano, J. L. Reyes, and F. Lares.
Water, Air, and Soil Pollution WAPLAC, Vol. 32, No. 3/4, p 397-406, February 1987. 2 fig, 6 tab, 20 ref.

Descriptors: *Pollutant identification, *Analytical methods, *Bacterial analysis, *Wastewater, Isolation, Bacteria, Performance evaluation.

A survey on Chromobacterium sp. and Flavobacterium sp. was conducted in a waste stabilization pond system at Santo Tomas Atzingo, State of Mexico. Methods for the isolation and identification of Chromobacterium sp. and Flavobacterium sp. from wastewater were developed and proved to be efficient. The waste-stabilization ponds studied were designed to treat the domestic sewage of a small rural community engaged in agriculture and cattle raising. There is no defined method described in the literature to isolate Flavobacterium and Chromobacterium bacteria from treatment systems; therefore new isolation and identification procedures are proposed. Non-measurable DO did not impede the presence of Chromobacterium and

Flavobacterium strains in the pond system since they are able to utilize nitrates as electron acceptors, using the O2 of their molecule to perform this reaction. pH and temperature in the ponds favored the growth of both strains. The CO2 levels in the ponds did not impede the growth of the isolates. The large amount of organic matter present in the system as well as other physicochemical parameters determined the greater incidence of Chromobacterium isolates over the Flavobacterium strains in the system. The relatively low incidence of Flavobacterium isolates in the ponds was probably determined more by biological factors (competition for nutrients, bacterial antagonism) than by physicochemical factors. The competition for nutrients between Flavobacterium and other genera such as Pseudomonas sp. and Chromobacterium isolated in simultaneous surveys probably determined the low incidence of Flavobacterium in the ponds. (Alexander-PTT)
W88-02500

ANALYSIS OF OZONE IN AQUEOUS SOLUTION,
North Carolina Univ., Chapel Hill.
For primary bibliographic entry see Field 5D.
W88-02508

DEVELOPMENT OF LEACHATE TESTING PROTOCOLS FOR DISPOSAL OF CONTAMINATED SEDIMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 5B.
W88-02522

METHOD FOR ESTIMATION OF METHYLMERCURY DISSOLVED INTO WATER FROM DREDGED MATERIAL BY USING THE MARINE COPEPOD ACARTIA CLAUSI,
Kumamoto Univ. (Japan).
R. Hirota, and, M. Fujiki, S. Tajima, and J. Asada.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 158-163, 1 fig, 2 tab, 3 ref.

Descriptors: *Methylmercury, *Path of pollutants, *Bioindicators, *Bioassay, *Dredging, *Acartia clausi, *Copepods, *Water quality, Monitoring, Bioconcentration, Mercury, Tissue analysis.

Floatable marine copepods (Acartia clausi) were reared for 24 hr in seawater containing sediment. The sediment contained 0.002 to 0.003 ppm of methylmercury and 32.46 to 59.01 ppm of total mercury. Before the start of the rearing experiments, the sediments were irradiated with sunlight for 6 hr a day for 23 days. The population density of the copepods was 10 to 41 individuals/L. The copepods were collected and methylmercury and total mercury in copepods were measured. Then dissolved methylmercury concentration in the seawater was estimated by the use of the correlation between the bioconcentration factor of methylmercury and population density of copepods, and by the use of methylmercury concentration in the copepods. The concentrations of methylmercury and total mercury in the copepods increased by 0.0045 to 0.17 ppm and 0.7 to 1.706 ppm, respectively. The estimated concentrations of dissolved methylmercury were 0.000012 to 0.00026 ppb. These concentrations correspond to 1/100 to 1/6 of methylmercury contents in the sediments used in the experiments. From the experiments, it was concluded that short-term sunlight irradiation and short-term exposure of aerobic condition did not form methylmercury from inorganic mercury in the sediments, but caused solution of methylmercury and inorganic mercury into the seawater from the sediments. (See also W88-02513) (Author's abstract)
W88-02523

BIOCHEMICAL METHODS FOR DETECTION OF SUBSURFACE CONTAMINATION/BIOMASS,
Oklahoma State Univ., Stillwater. Dept. of Biochemistry.
F. R. Leach, J. C. Chang, J. L. Howard, J. J. Webster, and A. B. Arquitt.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 241-269, 10 fig, 15 tab, 75 ref. EPA Grant No. R 804613. OkAgrExSt Project No. 1640 and No. 1806.

Descriptors: *Pollutant identification, *Groundwater pollution, *Analytical methods, *Biochemical analysis, *Biomass, Chemical analysis, Deoxyribonucleic acid, Ribonucleic acid, Proteins, Enzymes, Bioluminescence, Chemiluminescence.

The standard assays used in biochemical laboratories for DNA, RNA, protein, and organic phosphate, while excellent for most determinations, do not possess the sensitivity required with sparsely populated environmental samples. Assays with sufficient sensitivity for enzymes and cofactors could be developed using enzymatic cycling procedures. However, the sophisticated equipment and biochemical expertise required for these procedures limit their applicability, in general, to research laboratories. Assays based on bioluminescence, chemiluminescence, and cascaded enzymatic reactions are presently applicable to many environmental samples. By further optimization of conditions and additional study, the range of application of these techniques could be increased. Some simplification and better definition of parameters is also required. (See also W88-02533) (Lantz-PTT)
W88-02544

MICROBIOLOGICAL CHARACTERIZATION OF SUBSURFACE ENVIRONMENTS,
Cornell Univ., Ithaca, NY.
W. C. Ghiorse.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 387-401, 2 fig, 2 tab, 36 ref. EPA Subcontract No. 6931-5 under Coop Agr No. CR806931-02.

Descriptors: *Microbiological studies, *Groundwater quality, Microorganisms, Biomass, Electron microscopy, Scanning electron microscopy, Aufwuchs method, Epifluorescence microscopy, Tetrazolium dye reduction, Adenosine triphosphate, Autoradiography, Chemical analysis.

Indigenous microorganisms of groundwater-bearing subsurface environments may be characterized with respect to their identity, abundance, and metabolic activities. In the past, identification and estimates of microbial abundance in subsurface material have relied mainly on cultural techniques. However, cultural techniques are not ideal for identification because the types of microorganisms selected by cultivation on laboratory growth media may not truly represent the indigenous microflora. Thus, new methods are needed to aid identification of microorganisms in subsurface environments. In addition, cultural techniques are capable of detecting only a fraction - 1 to 10% in soil - of the microorganisms in a given environment; therefore, they can be expected to give only an underestimate of the abundance of subsurface microorganisms. Clearly, new methods capable of detecting a larger proportion of the microbial biomass are also needed. Several promising methods for the study of subsurface microorganisms are reviewed: (1) electron microscopy; (2) scanning electron microscopy; (3) Aufwuchs method; and (4) estimates of biomass via epifluorescence microscopy, chemical measurements of ATP, autoradiography, and tetrazolium dye reduction. (See also W88-02533) (Lantz-PTT)
W88-02551

WATER QUALITY ANALYTICAL TECHNIQUES,
Strathclyde Regional Council, Glasgow (Scotland).
For primary bibliographic entry see Field 5G.
W88-02646

DETERMINATION OF ALKALI AND ALKALINE EARTH IONS IN RAIN WATER BY ION CHROMATOGRAPHY (BESTIMMUNG VON ALKALI- UND ERDALKALIIONEN IN REGENWASSERPROBEN MIT DER IONENCHROMATOGRAPHIE),
Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Anorganische Chemie und Kernchemie.
R. Hill, and K. H. Lieser.
Fresenius' Zeitscrift fuer Analytische Chemie ZACFAU, Vol. 327, No. 2, p 165-169, May 1987. 5 fig, 4 tab, 21 ref.

Descriptors: *Water analysis, *Chemistry of precipitation, *Precipitation chemistry, *Water chemistry, *Trace elements, *Alkaline earth metals, *Ions, *Cations, *Analytical methods, *Measuring instruments, *Chromatography, Detection limits, Performance evaluation.

Alkali and alkaline earth ions in rain water can be determined by ion chromatography (IC) without preconcentration. The detection limits for alkali ions are between about 0.05 and 0.15 micromol/L and those for alkaline earth ions between about 0.2 and 0.6 micromol/L. The main advantages of IC are: very small sample volumes are sufficient; the simultaneous determination of the alkali ions or the alkaline earth ions requires less than 30 min; NH4(+) ions can also be determined. The results are compared with those obtained by flame AAS and AES-ICP. (Author's abstract)
W88-02671

GAS-CHROMATOGRAPHIC ELEMENTAL ANALYSIS VIA DI(TRIFLUOROETHYL)DITHIOCARBAMATO-CHELATES: X. CAPILLARY GAS CHROMATOGRAPHY AT THE PG-LEVEL - DETERMINATION OF CO AND CR(VI) BESIDES CR(III) IN RIVER WATER,
Mainz Univ. (Germany, F.R.). Inst. fuer Anorganische Chemie und Analytische Chemie.
H. Schaller, and R. Neeb.
Fresenius' Zeitscrift fuer Analytische Chemie ZACFAU, Vol. 327, No. 2, p 170-174, May 1987. 5 fig, 4 tab, 12 ref.

Descriptors: *Heavy metals, *Water analysis, *Trace elements, *Rivers, *Analytical methods, *Measuring instruments, *Chromatography, Detection limits, Performance evaluation, Sample preparation, Chromium, Cobalt, Chelation.

The capillary gas chromatographic determination of Cr(VI) besides Cr(III) and of Co in Rhine water is described. The previously reported optimized arrangement is used. Detection is performed with an ECD, extraction of the chelates from aqueous solution, pH 3, is carried out with a solid phase extraction system. The detection limits of Cr(VI) and Co are 0.05 ppb and 0.2 ppb, respectively. (Author's abstract)
W88-02672

ION-CHROMATOGRAPHIC DETERMINATION OF CHLOROACETATE AND DICHLORACETATE IN PRECIPITATIONS (IONENCHROMATOGRAPHISCHE BESTIMMUNG VON CHLORACETAT UND DICHLORACETAT IN NIEDERSCHLAGSWASSERPROBEN),
Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Anorganische Chemie und Kernchemie.
G. R. Fuchs, and K. Bachmann.
Fresenius' Zeitscrift fuer Analytische Chemie ZACFAU, Vol. 327, No. 2, p 205-212, May 1987. 10 fig, 5 tab, 27 ref.

Descriptors: *Chlorinated hydrocarbons, *Rainfall, *Analytical methods, *Pollutant identification, *Water analysis, *Measuring instruments, *Chromatography, Detection limits, Performance evaluation, Chemical reactions, Chloroacetates.

Chlorinated hydrocarbons are released to the atmosphere by anthropogenic activities. To some extent they are decomposed in the troposphere by chemical reactions. Chlorinated acyl chlorides were found as degradation products in laboratory studies. Chloroacetate and dichloroacetate are supposed to be formed by hydrolysis of the intermediately produced chlorinated acyl chlorides. A multidimensional ion-chromatographic method was developed to separate traces of chloroacetate and

dichloroacetate from the more than thousandfold excess of matrix ions. The limits of detection are 0.25 ng/ml chloroacetate and 0.4 ng/ml dichloroacetate. This technique is applied to the analysis of chloroacetate and dichloroacetate in precipitation samples. Mean concentrations of 1.5 ng/ml chloroacetate and 1.6 ng/ml dichloroacetate were found. (Author's abstract)
W88-02673

DETERMINATION OF ORGANIC GROUP PARAMETERS (AOCL, AOBR, AOS) IN WATER BY MEANS OF ION-CHROMATOGRAPHIC DETECTION,
Gesamthochschule Paderborn (Germany, F.R.).
G. Brandt, and A. Kettrup.
Fresenius' Zeitscrift fuer Analytische Chemie ZACFAU, Vol. 327, No. 2, p 213-219, May 1987. 11 fig, 8 tab, 23 ref.

Descriptors: *Water analysis, *Sample preparation, *Sulfur compounds, *Analytical methods, *Measuring instruments, *Chromatography, Detection limits, Performance evaluation, Sulfur, Charcoal, Adsorption.

The control of water quality is often performed by analysis of organic group parameters, e.g., 'Adsorbable Organic Halogen (AOX)'. The differentiation of the group parameter AOX and the determination of the parameter 'Adsorbable Organic Sulfur Compounds (AOS)' can be performed by ion-chromatography for detection of the anions obtained after pyrohydrolysis of the organic adsorbed compounds. Investigations concerning pyrohydrolysis of organic solutes and enrichment on a nearly chlorine- and sulfur-free active charcoal have been performed. By means of this charcoal the determination of organic sulfur solutes in the microgram/L range can be realized. (Author's abstract)
W88-02674

SYNCHRONOUS FLUORESCENCE SPECTRA OF NATURAL WATERS: TRACING SOURCES OF DISSOLVED ORGANIC MATTER,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 7B.
W88-02676

PROTOCOL FOR SAMPLING ENVIRONMENTAL SITES FOR LEGIONELLAE,
Center for Infectious Diseases, Atlanta, GA. Div. of Bacterial Diseases.
J. M. Barbaree, G. W. Gorman, W. T. Martin, B. S. Fields, and W. E. Morrill.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 7, p 1454-1458, July 1987. 4 tab, 18 ref.

Descriptors: *Analytical methods, *Screening, *Legionella, *Hospitals, *Public health, Isolation, Cooling towers, Epidemiology, Diseases.

A protocol for sampling environmental sites was developed and used to identify possible sources of Legionella species in support of epidemiologic investigations at two hospitals. In hospital A, legionellae were isolated from 43 of 106 (40%) different sites. Three separate Legionella pneumophila serotypes and a previously unrecognized species were present in different combinations in the positive samples. Two of five cooling towers contained the same L. pneumophila serogroup 1 monoclonal type (1,2,4,5) as was isolated from patients. The same monoclonal type was also isolated from make-up water for the two cooling towers, a hot water tank, water separators in four main air compressor systems for respiratory therapy, and cold and hot water faucets. In hospital B, 13 of 37 (38%) sample sites contained legionellae, all of which were L. pneumophila serogroup 1. The monoclonal type matching isolates from patients (1,2,4,5) was found at the highest concentration in a hot water tank, but it was also present at four other sample sites. Since legionellae not related to disease may be found in many of the sites sampled, an epidemiologic association with the probable source should be established before intervention methods, such as disinfection, are undertaken. (Author's abstract)
W88-02704

CHANGES IN ESCHERICHIA COLI CELLS STARVED IN SEAWATER OR GROWN IN SEAWATER-WASTEWATER MIXTURES,
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
For primary bibliographic entry see Field 5B.
W88-02706

RAPID ASSAY FOR MICROBIALLY REDUCIBLE FERRIC IRON IN AQUATIC SEDIMENTS,
Geological Survey, Reston, VA. Water Resources Div.
D. R. Lovley, and E. J. P. Phillips.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 7, p 1536-1540, July 1987. 3 fig, 2 tab, 12 ref.

Descriptors: *Hydroxylamine, *Biodegradation, *Analytical methods, *Iron, *Water analysis, *Sediments, *Microorganisms, Cultures, Anaerobic conditions, Reduction.

The availability of ferric iron for microbial reduction as directly determined by the activity of iron-reducing organisms was compared with its availability as determined by a newly chemical assay for microbially reducible iron. The chemical assay was based on the reduction of poorly crystalline ferric iron by hydroxylamine under acidic conditions. There was a strong correlation between the extent to which hydroxylamine could reduce various synthetic ferric iron forms and the susceptibility of the iron to microbial reduction in an enrichment culture of iron-reducing organisms. When sediments that contained hydroxylamine-reducible ferric iron were incubated under anaerobic conditions, ferrous iron accumulated as the concentration of hydroxylamine-reducible ferric iron declined over time. Ferrous iron production stopped as soon as the hydroxylamine-reducible ferric iron was depleted. In anaerobic incubations of reduced sediments that did not contain hydroxylamine-reducible ferric iron, there was no microbial iron reduction, even though the sediments contained high concentrations of oxalate-extractable ferric iron. A correspondence between the presence of hydroxylamine-reducible ferric iron and the extent of ferric iron reduction in anaerobic incubations was observed in sediments from an aquifer and in fresh- and brackish-water sediments from the Potomac River estuary. The assay is a significant improvement over previously described procedures for the determination of hydroxylamine-reducible ferric iron because it provides a correction for the high concentrations of solid ferrous iron which may also be extracted from sediments with acid. This is a rapid, simple technique to determine whether ferric iron is available for microbial reduction. (Author's abstract)
W88-02708

COMPARISON OF MEDIA FOR RECOVERY OF TOTAL COLIFORM BACTERIA FROM CHEMICALLY TREATED WATER,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
E. W. Rice, R. R. Fox, H. D. Nash, E. J. Read, and A. P. Smith.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 7, p 1571-1573, July 1987. 2 tab, 9 ref.

Descriptors: *Culturing media, *Analytical methods, *Comparison studies, *Bacteria, *Coliforms, *Treated water, Recovery, Isolation, Cultures.

Five broth media and two solid media were compared for their ability to quantitatively recover total coliform bacteria from chemically treated water. M-Endo LES and mT7 media were used in the membrane filter technique. Lauryl tryptose broth, lactose broth, presence-absence broth, lactose broth with twice the amount of lactose, and lauryl tryptose broth with twice the amount of sodium lauryl sulfate were used in the fermentation tube procedure. The differences in recovery were not significant for the five broth media and M-Endo LES agar. The M-Endo LES and mT7 media were not significantly different; however, the five broth media did yield significantly higher counts than mT7. (Author's abstract)
W88-02710

BACTERIOPHAGES ACTIVE AGAINST BACTEROIDES FRAGILIS IN SEWAGE-POLLUTED WATERS,
Barcelona Univ. (Spain). Dept. of Microbiology.
C. Tartera, and J. Jofre.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 7, p 1632-1637, July 1987. 6 tab, 55 ref.

Descriptors: *Analytical methods, *Bioassay, *Wastewater treatment, *Bacteriophages, *Detection, Performance evaluation, Cultures, Sediments, Feces.

Twelve strains of different Bacteroides species were tested for their efficiency of detection of bacteriophages from sewage. The host range of several isolated phages was investigated. The results indicated that there was a high degree of strain specificity. Then, by using Bacteroides fragilis HSP 40 as the host, which proved to be the most efficient for the detection of phages, feces from humans and several animal species and raw sewage, river water, water from lagoons, seawater, groundwater, and sediments were tested for the presence of bacteriophages that were active against B. fragilis HSP 40. Phages were detected in feces of 10% of the human fecal samples tested and was never detected in feces of the other animal species studied. Moreover, bacteriophages were always recovered from sewage and sewage-polluted samples of waters and sediments, but not from nonpolluted samples. The titers recovered were dependent on the degree of pollution in analyzed waters and sediments. (Author's abstract)
W88-02711

FREE-LIVING DINITROGEN-FIXING BACTERIA ISOLATED FROM PETROLEUM REFINERY OILY SLUDGE,
Lyon-1 Univ., Villeurbanne (France). Lab. d'Ecologie Microbienne.
G. Laguerre, B. Bossand, and R. Bardin.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 7, p 1674-1678, July 1987. 2 fig, 3 tab, 20 ref. Ecologie Microbienne UA CNRS 696.

Descriptors: *Pollutant identification, *Dinitrogen fixing activity, *Wastewater disposal, *Oily water, *Oilfield wastes, *Industrial wastewater, *Refinery wastes, *Sludge, *Bacteria, Isolation, Oil, Enzymes, Cultures, Microorganisms.

Dinitrogen-fixing activity (acetylene reduction and 15N2 fixation) was found in an oily sludge originating from a petroleum refinery. Two representative dinitrogen-fixing bacterial strains were isolated from this oily waste. Their nitrogenase activity was effective when they were cultivated on sterilized sludge or simple carbon substrates (organic acid salts, sugars). Using the classical methods, these strains could not be unambiguously related to other diazotrophic taxa. The landfarming process is widely used for oily sludge disposal; this study shows that oily sludges are more than a simple carbon input into the soil but that they must also be considered as real sources of dinitrogen-fixing and probably degradative microorganisms. (Author's abstract)
W88-02712

SIMULTANEOUS DETERMINATION OF NITRIFICATION AND NITRATE REDUCTION IN SEDIMENT-WATER COLUMNS BY NITRATE-15 DILUTION,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 5B.
W88-02718

SENSITIVE METHODS FOR THE DETERMINATION OF MICROBIAL ACTIVITIES IN WATER SAMPLES USING FLUORIGENIC SUBSTRATES,
ESWE-Inst. fuer Wasserforschung und Wassertechnologie G.m.b.H., Weisbaden (Germany, F.R.).
A. Holzapfel-Pschorn, U. Obst, and K. Haberer.
Fresenius Zeitscrift fuer Analytische Chemie ZACFAU, Vol. 327, No. 5/6, p 521-523, June 1987. 1 fig, 1 tab, 5 ref.

Descriptors: *Water analysis, *Analytical methods, *Microbial activity, *Enzymes, *Fluorimetry, *Dyes, Turnover rate, Detection limits, Biomass, Performance evaluation.

Sensitive methods for the determination of several catabolic enzyme activities in the natural water cycle as well as in water treatment plants have been developed. The tests are based on the fluorimetric measurement of dyes which are released by enzymatic cleavage from fluorigenic substrates added to the water sample. On the basis of a linear reaction the turnover rate can be calculated. Compared to photometric tests the detection limits are lower by a factor of 20 to 500, which now allows a precise study of the catabolic activity in samples with low biomass density. In addition, the use of fluorigenic substrates for the determination of microbial enzyme activities provides a higher precision in shorter reaction times compared to photometric tests. In detail, instructions for the determination of esterase, phosphatase, aminopeptidase and glucosidase activities are presented. (Author's abstract)
W88-02723

ION-CHROMATOGRAPHIC TRACE ANALYSIS OF AMPEROMETRICALLY DETECTABLE ANIONS IN WATER (IONEN-CHROMATOGRAPHISCHE SPURENANALYSE AMPEROMETRISCH DETEKTIERBARER ANIONEN IN WASSERN),
Stuttgart Univ. (Germany, F.R.). Inst. fuer Lebensmittelchemie.
G. Schwedt, and B. Rossner.
Fresenius Zeitscrift fuer Analytische Chemie ZACFAU, Vol. 327, No. 5/6, p 499-502, June 1987. 3 fig, 4 tab, 10 ref.

Descriptors: *Analytical methods, *Water analysis, *Chromatography, *Measuring instruments, Bromides, Iodides, Thiocyanates, electrodes, Detection limits, Ion pairs.

After an ion-pair reverse-phase hplc with cetyltrimethylammonium-chloride as ion-pair reagent, bromide, iodide, nitrite and thiocyanate are detectable at a glassy carbon electrode in a scope from 1 to 500 ppb. The separation system was varied by methanol resp. acetonitrile as modifier, the detection system by different deposition potentials between + 1.0 and + 1.7 V. Iodide and thiocyanate traces are enrichable from waters by extraction of ion-pairs in chloroform before ion-chromatographic analysis and are detectable below 1 ppb. For nitrite, bromide and iodide the results of a comparison of methods by photometric continuous-flow-analysis and isotope dilution mass spectrometry in drinking waters are presented. (Author's abstract)
W88-02724

PRECONCENTRATION OF SILVER(I), GOLD(III) AND PALLADIUM(II) IN WATER SAMPLES WITH 2,2'-DIPYRIDYL-3-((4-AMINO-5-MERCAPTO)-1,2,4-TRIAZOLYL)HYDRAZONE SUPPORTED ON SILICA GEL,
Thessaloniki Univ., Salonika (Greece). Lab. of Analytical Chemistry.
C. Samara, and T. A. Kouimtzis.
Fresenius Zeitscrift fuer Analytische Chemie ZACFAU, Vol. 327, No. 5/6, p 509-512, June 1987. 1 fig, 5 tab, 9 ref.

Descriptors: *Analytical methods, *Water analysis, *Chromatography, *Sample preparation, *Silver, *Gold, *Palladium, Acidity, Recovery, Precious metals, Spectrometry.

2,2'-Dipyridyl-3-(4-amino-5-mercapto)-1,2,4-triazolyl) hydrazone, supported on silica gel (DPTH-SG), is used to preconcentrate traces of silver(I), gold(III) and palladium(II) from water samples. In batch experiments, silver is quantitatively retained on the DPTH-SG at acidities ranging from 1 M HNO3 to pH 6, whereas the retention of gold and palladium is quantitative in the pH range 1.5-3.5. Conditions for the quantitative recovery of silver, gold and palladium from water samples on DPTH-SG columns are established. Silver and palladium retained on the DPTH-SG column are completely eluted with 0.1% thiourea in 0.1 M nitric or hydrochloric acid. Under the same conditions only 75% of gold retained on the column is eluted. Quantitative elution of the three metals is achieved with 0.1 M potassium cyanide solution. The metals are determined in the effluent by atomic absorption spectrometry. Results obtained by application of the proposed method to spiked tap and sea water samples are presented. (Author's abstract)
W88-02725

ECOLOGY OF AEROMONADS AND ISOLATION FROM ENVIRONMENTAL SAMPLES,
Frankfurt Univ. (Germany, F.R.). Zentrum der Hygiene.
R. Schubert.
Experientia EXPEAM, Vol. 43, No. 4, p 351-354, April 1987. 4 tab, 18 ref.

Descriptors: *Aeromonads, *Bacteria, *Public health, Bacteria isolation, Bacterial analysis, Bacterial physiology, Ecology, Aquatic environment, Isolation.

The knowledge of the ecology of aeromonads has made little progress over the past ten years because of unsatisfactory procedures for isolation of these bacteria. Aeromonads were identified on a routine basis previously only by phenotyping which lead to preliminary ecological results with respect to the genetic level. Nomenclature and isolation procedures taking the close interrelationships of the different psychotrophic Aeromonas species into account were presented. Details on the use of Dextrin-fuchsin sulfite (DFS) agar for the isolation of aeromonads from environmental samples, and on methods for the examination of contaminated and uncontaminated waters were provided. The public health importance of aeromonads in drinking water is not yet fully understood though guidelines for their occurrence were given. (Wood-PTT)
W88-02799

WATER ANALYSIS,
P. MacCarthy, R. [illegible] Klusman, and J. A. Rice.
Analytical Chemistry ANCHAM, Vol. 59, No. 12, p 308R-337R, June 15, 1987. 741 ref.

Descriptors: *Water analysis, *Pollutant identification, *Chemical analysis, Reviews, *Literature review, *Chemical precipitation, Inorganic analysis, Metals, Radiochemical analysis, Anions, Gas analysis, Organic compounds, Organic analysis, Chromatography, Gas chromatography, Liquid chromatography, Mass spectrometry, Photometry, Spectrophotometry, Water sampling, Surfactants, Detergents, Pesticides, Herbicides, Fungicides, Trace levels, Testing procedures, Detection limits.

The twenty-second biennial review dealing with the inorganic and organic analytical chemistry of water was compiled by computer-search of Chemical Abstracts covering the period from the previous review (September 2984) through October 1986. Methods for the quantification and identification of chemicals in water are reviewed. Sections include inorganic analysis of all types of metals, selected non-metals, radionuclides, anions, gases, organic analysis by gas chromatography, liquid chromatography, high-performance liquid chromatography, mass spectrometry, photometry, and spectrophotometry. Methods of sampling, preconcentration, extraction and separation are mentioned. Methods for quantitation of surfactants, detergents, pesticides, herbicides and fungicides at trace levels are also reviewed. (Wood-PTT)
W88-02804

GAS CHROMATOGRAPHIC DETECTION OF BACTERIA CAUSING ENTERIC FEVER,
Defence Research and Development Establishment, Gwalior (India). Div. of Microbiology.
K. S. Manja, and R. K. Kaul.
Journal of Chromatography JOCRAM, Vol. 415, No. 2, p 377-382, April 10, 1987. 1 fig, 2 tab, 14 ref.

Descriptors: *Enteric bacteria, *Pollutant identification, *Gas chromatography, *Bacteria, *Analytical methods, Fermentation, Chromatography, Infection, Diseases, Pathology, Human diseases.

Enteric fever is one of the most common waterborne infections caused by Salmonella typhi and Salmonella paratyphi A, B, and C. The conventional methods for the isolation of these bacteria normally take 3-4 days and the confirmation by biochemical and serological techniques takes an additional 2-3 days. A simple gas chromatographic (GC) method for the detection of Salmonella sp. is reported which is based on the detection of ethanol as a metabolic product from the fermentation of rhamnose and specific suppression of ethanol production by preservative-free Salmonella polyvalent H antiserum in parallel cultures. Strains of Salmonella consistently ferment rhamnose, splitting the sugar to yield ethanol which can easily be detected by GC. Salmonella polyvalent H antiserum was used for the specific suppression of Salmonella, which confirmed the presence of the bacteria. The use of antiserum in this GC technique is critical because commercial antisera contain cresol or merthiolate, which are non-specific inhibitors, as preservatives. Results of the GC method for detection of the bacteria were available in 24 hours. This direct diagnosis technique can be used to establish the presence of viable organisms in blood, which is more relevant in an active disease than detection of antigens or antibodies in the blood. (Wood-PTT)
W88-02805

METHODS OF IMMOBILIZING SOIL CONTAMINATION (METHODEN ZUR IMMOBILISIERUNG VON BODENKONTAMINATIONEN),
Envi-Sann G.m.b.H., Schmitten (Germany, F.R.).
For primary bibliographic entry see Field 5G.
W88-02814

DETERMINATION OF ALKALI AND ALKALINE EARTH IONS IN RAIN WATER BY ION CHROMATOGRAPHY (BESTIMMUNG VON ALKALI- UND ERDALKALIIONEN IN REGENWASSERPROBEN MIT DER IONEN-CHROMATOGRAPHIE),
Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Anorganische Chemie und Kernchemie.
R. Hill, and K. H. Lieser.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 327, No. 2, p 165-169, May 1987. 5 fig, 4 tab, 21 ref.

Descriptors: *Rain analysis, *Analytical methods, *Alkaline earth metals, *Detection limits, *Detection times, *Ammonium, Bases, Ion chromatography, Atomic absorption spectroscopy, Ions, Trace levels, Cations, Chemical analysis.

Alkali and alkaline earth ions in rain water can be determined by ion chromatography (IC) without preconcentration. The detection limits for alkali ions are between about 0.05 and 0.15 micromoles/l and those for alkaline earth ions between about 0.2 and 0.6 micromoles/l. The main advantages of IC are very small sample volumes are sufficient, the simultaneous determination of the alkali ions or the alkaline earth ions requires less than 30 minutes, and NH4(+) ions can also be determined. The results are compared with those obtained by flame AAS and AES-ICP. (Author's abstract)
W88-02816

GAS-CHROMATOGRAPHIC ELEMENTAL ANALYSIS VIA DI(TRIFLUOROETHYL) DITHIOCARBAMATO CHELATES: X. CAPILLARY GAS CHROMATOGRAPHY AT THE PG-

LEVEL - DETERMINATION OF CO AND CR(VI) BESIDES CR(III) IN RIVER WATER,
Mainz Univ. (Germany, F.R.). Inst. fuer Anorganische Chemie und Analytische Chemie.
H. Schaller, and R. Neeb.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 327, No. 2, p 170-174, May 1987. 5 fig, 4 tab, 12 ref.

Descriptors: *Gas chromatography, *Chelating agents, *Rhine river, *Water analysis, *Analytical methods, Chemical analysis, Cations, Heavy metals, Chromium, Cobalt.

The capillary gas chromatographic determination of Cr(VI) along with Cr(III) and of Co in Rhine River water is described. A metal chelate is formed, which is extracted from the aqueous solution at pH 3 using a solid phase extraction system. The detection limits of Cr(VI) and Co are 0.05 ppb and 0.2 ppb, respectively. Additional work is required on the optimization of the extraction of metal chelates for gas chromatography so that the chromatographic determination of metals via metal chelates can become a more routinely used method. The reagent reacts with a great variety of metals, but only the very stable chelates, such as Cr, Co, Ni, and the noble metal chelates, can be chromatographed at the pg-level at elution times within the order of 10-40 min. More labile chelates, which are well separated from all the other components can be eluted at the pg-level under other conditions; for such an approach, megabore columns with thick films hold promise. (Airone-PTT)
W88-02817

ION-CHROMATOGRAPHIC DETERMINATION OF CHLOROACETATE AND DICHLOROACETATE IN PRECIPITATION (IONENCHROMATOGRAPHISCHE BESTIMMUNG VON CHLOROACETAT UND DICHLOROACETAT IN NIEDERSCHLAGSWASSERPROBEN),
Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Anorganische Chemie und Kernchemie.
G. R. Fuchs, and K. Baechmann.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 327, No. 2, p 205-212, May 1987. 10 fig, 5 tab, 27 ref.

Descriptors: *Chlorinated hydrocarbons, *Chemical analysis, *Rain analysis, *Water analysis, *Analytical methods, Detection limits, Water pollution sources, Organic acids, Ion chromatography.

Chlorinated hydrocarbons are released to the atmosphere by anthropogenic activities. To some extent they are decomposed in the troposphere by chemical reactions. Chlorinated acyl chlorides were found as degradation products in laboratory studies. Chloroacetate and dichloroacetate are supposed to be formed by hydrolysis of the intermediately produced chlorinated acyl chlorides. A multidimensional ion-chromatographic method was developed to separate traces of chloroacetate and dichloroacetate from the more than thousandfold excess of matrix ions. The limits of detection are 0.25 ng/ml chloroacetate and 0.4 ng/ml dichloroacetate. This technique is applied to the analysis of chloroacetate and dichloroacetate in precipitation samples. Mean concentrations of 1.5 ng/ml chloroacetate and 1.6 ng/ml dichloroacetate were found. (Author's abstract)
W88-02818

DETERMINATION OF ORGANIC GROUP PARAMETERS (AOCL, AOBR, AOS) IN WATER BY MEANS OF ION-CHROMATOGRAPHIC DETECTION,
Gesamthochschule Paderborn (Germany, F.R.). Fachbereich 13 - Chemie und Chemietechnik.
G. Brandt, and A. Kettrup.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 327, No. 2, p 213-219, May 1987. 11 fig, 8 tab, 23 ref.

Descriptors: *Halogens, *Sulfur, *Chemical analysis, *Water analysis, *Analytical methods, *Ion chromatography, Chlorinated hydrocarbons, Drinking water, Water quality control, Anions.

Water quality is often analyzed for organic group parameters such as Adsorbable Organic Halogen (AOX). The differentiation of the group parameter AOX and the determination of the parameter Adsorbable Organic Sulfur Compounds (AOS) can be performed by ion chromatography for detection of the anions obtained after pyrohydrolysis of the organic adsorbed compounds. Pyrohydrolysis of organic solutes was studied using enrichment on a nearly chlorine- and sulfur-free active charcoal. By means of this charcoal organic sulfur solutes may be determined in the microg/l range. (Author's abstract)
W88-02819

ELECTROMETRIC DETERMINATION OF THE PH OF ATMOSPHERIC PRECIPITATION,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
V. D. Nguyen, and P. Valenta.
Fresenius' Zeitscrift fuer Analytische Chemie ZACFAU, Vol. 327, No. 3/4, p 253-260, June 1987. 11 fig, 7 tab, 16 ref.

Descriptors: *Analytical methods, *Measuring instruments, *Rain analysis, *Acid rain, *Water analysis, *Acidity, *Hydrogen ion concentration, *Rainfall, *Hydrogen ion concentration, Precipitation, Atmosphere.

Reliable pH-determination of rain water represents a difficult task both from the theoretical and practical point of view because the chemical composition and conductivity of rain water samples varies widely. The method for determining the pH is described that was used during the systematic study of the acidity of rain in various regions of the FRG from 1980 to 1985 and the problems encountered are discussed. Potential sources of error are inadequate sampling, sample storage, and electrometrical pH-determination of samples with a very low conductivity. The use of various types of electrodes, their pretreatment, storage and time response as well as the accuracy of the determination are discussed. Examples are given of the application of the method for determining the time dependence of the pH during single rain events in Julich as well as average monthly pH-values in polluted and non-polluted regions in the Federal Republic of Germany. (Author's abstract)
W88-02854

RESEARCH IN ENVIRONMENTAL POLLUTION: III. DETERMINATION OF NITROFEN IN MAIN- AND RHINEFISH(UNTERSUCHUNGEN ZUR UMWELTBELASTUNG: III. BESTIMMUNG VON NITROFEN IN MAIN- UND RHEINFISHEN),
Hessische Landwirtschaftliche Versuchsanstalt, Darmstadt (Germany, F.R.).
For primary bibliographic entry see Field 5B.
W88-02856

EXTRACTION AND RECOVERY OF POLYCYCLIC AROMATIC HYDROCARBONS FROM ENVIRONMENTAL SOLIDS USING SUPERCRITICAL FLUIDS,
North Dakota Univ., Grand Forks. Energy Research Center.
S. B. Hawthorne, and D. J. Miller.
Analytical Chemistry ANCHAM, Vol. 59, No. 13, p 1705-1708, July 1987. 2 fig, 3 tab, 17 ref. EPA Grant R-812229-01-0.

Descriptors: *Analytical methods, *Extractions, *Polycyclic aromatic hydrocarbons, *Supercritical fluids, Sediments, Organic compounds, Recovery, Labeled compounds.

The use of supercritical fluids for the extraction and recovery of polycyclic aromatic hydrocarbons (PAH) from environmental solids has been developed and tested by using urban dust, fly ash, and river sediment. Supercritical N2O with 5% methanol modifier gave the best recoveries of PAH from all three samples when compared to supercritical CO2 with 5% methanol, N2O,CO2, ethane. Quantitative recovery of PAH from National Bureau of Standards SRM 1649 (urban dust) and of deuterated PAH spikes (phenanthrene-d10, pyrene-d10, and perylene-d12) from the river sediment was obtained with supercritical fluid extractions in as little as 30 min. In most cases, 30-60 min extractions of the river sediment and fly ash with supercritical N2O/5% methanol gave better recovery of the deuterated PAH spikes than the recoveries obtained by using 4 h of sonication or 8 h of Soxhlet extraction with either benzene or methylene chloride. Supercritical fluid extractions yield good PAH recoveries, require only small amounts of sample, minimize analyte concentration steps, and are simple and rapid to perform. (Author's abstract)
W88-02858

DETERMINATION OF VOLATILE PRIORITY POLLUTANTS IN WATER BY PURGE AND TRAP AND CAPILLARY COLUMN GAS CHROMATOGRAPHY/MASS SPECTROMETRY,
Acurex Corp., Mountain View, CA. Environmental Systems Div.
V. Lopez-Avila, R. Wood, M. Flanagan, and R. Scott.
Journal of Chromatographic Science JCHSBZ, Vol. 25, No. 7, p 286-291, July 1987. 3 fig, 5 tab, 10 ref.

Descriptors: *Analytical methods, *Measuring instruments, *Chromatography, *Spectrometry, *Priority pollutants, *Organic compounds, Performance evaluation, Detection limits.

Two wide-bore capillary columns were evaluated for their applicability to the purge-and-trap technique and GC/MS analysis of 34 volatile organics. Neither column was able to completely resolve all 34 compounds, as is also typical of the packed column; however, the analysis was faster than with the packed column (18 to 21 min compared to 30 min), and the column effluent was introduced directly into the mass spectrometer without requiring an open-split interface. Method precision, as assessed from the instrument response at a concentration of 50 microgram(ug)/L per component, is better than + or - 5% for 41% of the compounds using the VOCOL column (diphenyl dimethyl polysiloxane with crosslinking moieties) and for 53% of the compounds using the 007 column (95% methyl 5% phenyl silicone). The instrument response is linear from 20 to 200 ug/L for most compounds, and the amounts loaded to either column without serious distortion of the peak shape or resolution can be as high as 5 ug per component. Because the VOCOL column resolved more compounds than the 007 column within approximately the same analysis time, this column was further tested for performance with groundwater samples. (Author's abstract)
W88-02859

DETERMINATION OF ALKYLBENZENESULFONATE SURFACTANTS IN GROUNDWATER USING MACRORETICULAR RESINS AND CARBON-13 NUCLEAR MAGNETIC RESONANCE SPECTROMETRY,
Geological Survey, Denver, CO. Water Resources Div.
E. M. Thurman, T. Willoughby, L. B. Barber, and K. A. Thorn.
Analytical Chemistry ANCHAM, Vol. 59, No. 14, p 1798-1802, July 1987. 5 fig, 2 tab, 23 ref.

Descriptors: *Analytical methods, *Measuring instruments, *Alkylbenzene sulfonates, *Water analysis, *Nuclear magnetic resonance, *Pollutant identification, *NMR, *Surfactants, *Groundwater, *Ion exchange, Sample preparation, Extraction, Field tests.

Alkylbenzenesulfonate surfactants were determined in groundwater at concentrations as low as 0.3 mg/L. The method uses XAD-8 resin for concentration, followed by elution with methanol, separation of anionic and nonionic surfactants by anion exchange, quantitation by titration, and identification by 13C nuclear magnetic resonance spectrometry. Laboratory standards and field samples

containing straight-chain and branched-chain alkylbenzenesulfonates, sodium dodecyl sulfate, and alkylbenzene ethoxylates were studied. The XAD-8 extraction of surfactants from groundwater was completed in the field, which simplified sample preservation and reduced the cost of transporting samples. (Author's abstract)
W88-02860

SELECTIVE PRECONCENTRATION OF IRON IN BEVERAGES AND WATER SAMPLES USING 2,4,6-TRI-2-PYRIDINYL-1,3,5-TRIAZINE-TETRAPHENYLBORATE-NAPHTHALENE ADSORBENT,
Indian Inst. of Tech., New Delhi. Dept. of Chemistry.
B. K. Puri, M. Satake, G. Kano, and S. Usami.
Analytical Chemistry ANCHAM, Vol. 59, No. 14, p 1850-1852, July 1987. 1 fig, 4 tab, 13 ref.

Descriptors: *Analytical methods, *Measuring instruments, *Iron, *Adsorption, *Sample preparation, *Complexes, Whiskey, Beer, Natural waters.

A solid ion pair material produced from 2,4,6-tri-2-pyridinyl-1,3,5-triazine-tetraphenylborate on naphthalene provides a very simple, rapid, and economical method for the preconcentration of iron from large volumes of whisky, beer, and natural water samples. Iron is quantitatively retained on this adsorbent in the pH range 3.3-7.0 and at a flow rate of 1-8 mL/min. The solid mass consisting of the metal complex along with naphthalene is dissolved from the column with 5 mL of dimethylformamide (DMF). The absorbance is measured at 597 nm with a spectrophotometer against the reagent blank. Beer's law is obeyed over the concentration range 0.2-8.0 microgram(ug) of iron in 5 mL of the final DMF solution. The molar absorptivity is 23,900 L/mol/cm. Eight replicate determinations of a sample solution containing 5 ug of iron gave a mean absorbance of 0.430 with a relative standard deviation of 0.79%. The interference of various ions has been studied and the method has been employed to the determination of iron in standard reference material, wine, beer, whisky, brandy, tomato juice, mixed vegetable juice, and natural water samples. (Author's abstract)
W88-02861

COMPARATIVE SURVIVAL OF ANTIBIOTIC-RESISTANT AND -SENSITIVE FECAL INDICATOR BACTERIA IN ESTUARINE WATER,
Massachusetts Univ. at Boston. Environmental Science Program.
G. W. Pettibone, S. A. Sullivan, and M. P. Shiaris.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 6, p 1241-1245, June 1987. 3 fig, 2 tab, 43 ref.

Descriptors: *Bioindicators, *Survival, *Antibiotic resistance, *Bacteria, *Estuaries, Cultures, Incubation.

The survival of antibiotic-resistant and -sensitive strains of Escherichia coli, Enterococcus faecalis, Enterococcus faecium, Streptococcus equinus, and two environmental isolates, AP17 and AQ17 and AQ62, was examined in estuarine water. Each strain was rendered resistant to a combination of two antibiotics by serial passage in increasing concentrations of antibiotics. Cultures were incubated in filter-sterilized estuarine water for up to 7 days. Recovery was assessed by examining colony-forming ability on media with and without antibiotics. None of the antibiotic-resistant forms survived longer than its antibiotic-sensitive counterpart in estuarine water. Three of the resistant strains died off more rapidly. than the antibiotic-sensitive wild type. Survival of the test bacteria in estuarine water was as follows: sensitive and resistant AQ62, resistant Escherichia coli < sensitive Escherichia coli < resistant AP17 < resistant Enterococcus faecium < sensitive AP17, sensitive and resistant S. equinus < sensitive and resistant Enterococcus faecalis, sensitive Enterococcus faecium. The results supported the suggestion that fecal entercocci may serve as better indicators of fecal pollution than Escherichia coli in marine ecosystems. Moreover, the results indicated that the use of antibiotic-resistant mutants to follow the fate of bacteria in the environment is inappropriate without adequate studies to ensure that resistant and wild-type strains react similarly to environmental stressors. (Author's abstract)
W88-02866

IMPROVED MEMBRANE FILTRATION MEDIA FOR ENUMERATION OF TOTAL COLIFORMS AND ESCHERICHIA COLI FROM SEWAGE AND SURFACE WATERS,
Iowa State Univ., Ames.
T. A. Freier, and P. A. Hartman.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 6, p 1246-1250, June 1987. 6 tab, 31 ref.

Descriptors: *Analytical methods, *Coliforms, *Bacteria, *Wastewater, *Surface water, Cultures, Culturing media, Bioindicators.

Two media were developed that allowed both a total coliform count and an Escherichia coli count to be determined on the same medium after 24 h of incubation at 35 C. The new media were tested along with two standard media on 10 surface water and 7 sewage samples. The experimental media yielded equivalent or higher counts relative to the standard media and recovered more specifically the desired indicator groups as determined by colony identification. (Author's abstract)
W88-02867

INCIDENCE OF VIBRIO CHOLERAE FROM ESTUARIES OF THE UNITED STATES WEST COAST,
Food and Drug Administration, Seattle, WA. Seafood Products Research Center.
For primary bibliographic entry see Field 5B.
W88-02871

VIRULENT STRAINS OF VIBRIO VULNIFICUS ISOLATED FROM ESTUARIES OF THE UNITED STATES WEST COAST,
Food and Drug Administration, Seattle, WA. Seafood Products Research Center.
For primary bibliographic entry see Field 5B.
W88-02872

NEUTRON ACTIVATION AND ATOMIC ABSORPTION ANALYSIS OF ULVA LACTUCA AND GRACILARIA VERRUCOSA FROM THERMAIKOS GULF, GREECE,
Sofia Univ. (Bulgaria). Khimicheski Fakultet.
R. Djingova, I. Kuleff, S. Arpadjan, and S. Alexandrov.
Toxicological and Environmental Chemistry TXECBP, Vol. 15, No. 3, p 149-158, 1987. 4 fig, 2 tab, 10 ref.

Descriptors: *Analytical methods, *Measuring instruments, *Coastal waters, *Ulva, *Neutron activation, *Atomic absorption, Metals, Ions, Greece, Algae, Water pollution sources.

NAA and AAS have been applied to determine the content of As, Br, Ca, Cd, Co, Cr, Cu, Fe, K, La, Mn, Na, Ni, Pb, Sb, Sc, Sm and Zn in Ulva lactuca and Gracilaria verrucosa from Thermaikos Gulf, Greece. The analytical data has been subjected to cluster and stepwise discriminant analysis. Thus the influence of some industrial sources on the pollution of water in the Gulf is detected and correlation between Zn-Co-Cr-La; Br-K; Cu-Ni; Cd-Sb-Mn in the investigated algae is established. (Author's abstract)
W88-02880

CHEMICAL CHARACTERIZATION OF A WATER SOLUBLE FRACTION (WSF) OF CRUDE OIL,
Centre d'Oceanologie de Marseille (France).
R. Siron, J.-F. Rontani, and G. Giusti.
Toxicological and Environmental Chemistry TXECBP, Vol. 15, No. 3, p 223-229, 1987. 3 fig, 1 tab, 14 ref.

Descriptors: *Analytical methods, *Oil pollution, *Water pollution, *Chemical analysis, Solubility, Seawater, Hydrocarbons, Extraction.

Very polar oil compounds are predominant in the resulting water soluble fraction (WSF) of crude oil, in agreement with their high solubility in seawater. Non-volatile hydrocarbons represent only a low proportion of total soluble extracts. The experimental process achieved allows one to obtain quantitative and reproducible soluble oil extracts that could be used in ecotoxicological tests and for the study and the characterization of marine oil pollution. (Author's abstract)
W88-02884

METHOD FOR MEASURING ENRICHED LEVELS OF DEUTERIUM IN SOIL WATER,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 2G.
W88-02891

MICROBIOLOGICAL WATER QUALITY OF IMPOUNDMENTS: A LITERATURE REVIEW,
Texas Univ. at Dallas, Richardson. Center for Environmental Studies.
G. A. Burton.
Available from the National Technical Information Service, Springfield, VA 22161, as ADA-123470, A04 in paper copy, A01 in microfiche. Miscellaneous Paper E-82-6, December 1982. Final Report. Army Engineer Waterways Experiment Station, Vicksburg, MS. 54 p, 5 tab, 208 ref.

Descriptors: *Microbiological studies, *Reservoirs, *Bacteria, *Water quality management, Bacterial analysis, Public health, Water resources development, Resources development, Water sampling, Water quality.

Reliable determination of future and present microbiological water quality requires knowledge of how the chemical, physical, and biological characteristics of the watershed and impoundment interrelate to influence microbial indicator and pathogen densities. Accurate estimates of microbial indicator and pathogen densities, obtainable by using the enumeration methods and their modifications suggested in the report, will allow monitoring of the proper indicator organisms and estimation of potential sites of pathogen occurrence, density, and survival. Sampling programs must be geared toward critical time periods and areas; i.e., summer months, storm flows, feeder streams, agricultural and urban runoff, and swimming areas, including water sediments. Frequency of sampling should be dictated by variability of water conditions, confidence level of data, and extent of human contact. (Author's abstract)
W88-02892

WATER-QUALITY DATA FOR AQUIFERS IN EAST-CENTRAL NEW JERSEY, 1981-82,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-02956

GROUND WATER QUALITY IN SOUTHEASTERN MINNESOTA,
Minnesota Univ., Minneapolis. School of Public Health.
R. D. Singer, M. T. Osterholm, and C. P. Straub.
WRRC Bulletin 109, October 1982. Minnesota Univ., St. Paul, Water Resources Research Center. 45 p, 13 fig, 4 tab, 38 ref.

Descriptors: *Groundwater, *Groundwater management, *Karst hydrology, *Groundwater pollution, Water pollution, Water quality, Water quality management, Water quality control, Water sampling, Wells.

Water quality of 21 wells in the karst area of southeastern Minnesota was studied from Feb. 1977 to May 1979. The wells were located within a one-township area and were chosen for study following a questionnaire survey by type of construction and aquifer(s) in which they were completed. Thirteen routine and six runoff samples were collected from each well during the study and were

examined for 18 biological, physical and chemical parameters. The parameters measured in samples from wells in the Galena Formation had the most variation with total coliform and nitrate nitrogen concentrations exceeding recommended limits for drinking water in 68 and 72 percent of the samples, respectively. Generally, it was found the median routine concentrations of all parameters studied were lower than the median runoff concentrations. There was evidence that the chemical quality of the water in the deeper aquifers supposedly protected by a major aquitard was affected rapidly by the surface runoff. The parameters found to be the best indicators of surface water contamination of the aquifers were: bacterial counts, nitrate nitrogen, turbidity, conductivity, sulfate, chloride, phosphate, total organic carbon, and sulfate/chloride and nitrate nitrogen/chloride ratios. (Author's abstract)
W88-02968

USE OF CHEMICAL TEST PAPERS TO SEMI-QUANTITATIVELY DETERMINE MERCURY-VAPOR CONCENTRATIONS,
Geological Survey, Bismarck, ND. Water Resources Div.
R. L. Houghton.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4012, 1985. 15 p, 5 fig, 3 tab, 10 ref.

Descriptors: *Mercury, *Chemical analysis, North Dakota, Analytical methods, Water analysis, Safety.

Mercury vapor is a health hazard and a potential source of contamination during water-quality sampling. Instrumental methods of detecting concentrations of mercury vapor require the purchase of expensive equipment and appreciable training of instrument operators. Test papers may provide a relatively inexpensive test for mercury vapor that can be conducted by personnel with minimal training. Palladium chloride and selenium sulfide test papers can detect concentrations of mercury vapors below the Federal maximum allowable concentration of 0.1 milligram per cubic meter permitted in the workplace. At temperatures between 0 C and 40 C, these test papers require about 2 hours of passive exposure to detect mercury vapor at the Federal maximum allowable concentration. Increasing the rate of air flow past test papers decreases reaction time roughly proportional to the square root of the velocity of air flow. Chemical test papers can be used to screen work areas for contamination with mercury vapor. Contaminated areas identified by the screening process can be confirmed using more sensitive instrumental methods of analysis. (USGS)
W88-02974

RECONNAISSANCE OF THE QUALITY OF SURFACE WATER IN THE SAN RAFAEL RIVER BASIN, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 2K.
W88-03005

PRECISION AND BIAS OF SELECTED ANALYTES REPORTED BY THE NATIONAL ATMOSPHERIC DEPOSITION PROGRAM AND NATIONAL TRENDS NETWORK--1983 AND JANUARY 1980 THROUGH SEPTEMBER 1984,
Geological Survey, Denver, CO. Water Resources Div.
L. J. Schroder, A. W. Bricker, and T. C. Willoughby.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4275, 1985. 15 p, 6 fig, 9 tab, 6 ref.

Descriptors: *Precipitation, *Water analysis, Chloride, Calcium, Precision, Blind-audit samples, Quality assurance, Water quality.

Blind-audit samples with known analyte concentrations have been prepared by the U.S. Geological Survey and distributed to the National Atmospheric Deposition Program's Central Analytical Laboratory. The difference between the National Atmospheric Deposition Program and National Trends Network reported analyte concentrations and known analyte concentrations have been calculated, and the bias has been determined. Calcium, magnesium, sodium, and chloride were biased at the 99-percent confidence limit; potassium and sulfate were unbiased at the 99-percent confidence limit, for 1983 results. Relative-percent differences between the measured and known analyte concentration for calcium, magnesium, sodium, potassium, chloride, and sulfate have been calculated for 1983. The median relative percent difference for calcium was 17.0; magnesium was 6.4; sodium was 10.8; potassium was 6.4; chloride was 17.2; and sulfate was -5.3. These relative percent differences should be used to correct the 1983 data before user-analysis of the data. Variances have been calculated for calcium, magnesium, sodium, potassium, chloride, and sulfate determinations. These variances should be applicable to natural-sample analyte concentrations reported by the National Atmospheric Deposition Program and National Trends Network for calendar year 1983. (USGS)
W88-03023

INTERLABORATORY COMPARABILITIES, BIAS, AND PRECISION FOR FOUR LABORATORIES MEASURING CONSTITUENTS IN PRECIPITATION, NOVEMBER 1982-AUGUST 1983,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03046

DISSOLVED-SELENIUM DATA FOR WELLS IN THE WESTERN SAN JOAQUIN VALLEY, CALIFORNIA, FEBRUARY TO JUNE 1985,
Geological Survey, Sacramento, CA. Water Resources Div.
J. M. Neil.
Available from USGS, OFSS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 86-73, 1986. 10 p, 1 fig, 4 tab, 6 ref.

Descriptors: *Selenium, *Water quality, *Water pollution, *Groundwater quality, *California, Groundwater, Areal distribution, Data summary.

Water samples were collected for selenium analysis from 63 wells in western San Joaquin Valley, California, during February to July 1985. Results of the data collection indicate that dissolved selenium concentrations ranged from less than 1 to 120 micrograms per liter; more than 50 percent of the wells sampled had concentrations of less than 1 microgram per liter. Four additional samples collected from public supply wells in the western valley had concentrations ranging from less than 1 to 2 micrograms per liter. All samples from five public supply wells east of the study area had concentrations less than 1 microgram per liter. The U.S. Environmental Protection Agency's drinking-water standard of 10 micrograms per liter for selenium was slightly exceeded in 2 of 39 domestic wells (11 and 13 micrograms per liter) and substantially exceeded in 2 of 11 irrigation and agricultural wells (55 and 120 micrograms per liter). (USGS)
W88-03084

WATER QUALITY DATA-COLLECTION ACTIVITIES IN COLORADO AND OHIO: PHASE I--INVENTORY AND EVALUATION OF 1984 PROGRAMS AND COSTS,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03087

MAP OF CALIFORNIA SHOWING DISTRIBUTION OF SELENIUM CONCENTRATIONS IN WELLS SAMPLED BY THE U.S. GEOLOGICAL SURVEY, 1975-1985,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03088

INVESTIGATION OF THE POSSIBLE FORMATION OF DIETHYLNITROSAMINE RESULTING FROM THE USE OF RHODAMINE WT DYE AS A TRACER IN RIVER WATERS,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03115

DEVELOPMENT OF AN IMPROVED TEST FOR THE DETERMINATION OF BIOCHEMICAL OXYGEN DEMAND,
Catholic Univ. of America, Washington, DC.
B. T. DeCicco, and E. LaForge.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-157005/AS. Price codes: A03 in paper copy, A01 in microfiche. District of Columbia Water Resources Research Center, Washington, Final Report. May 1985. 32 p, 8 fig, 6 tab, 14 ref. Contract No. 14-08-0001-G898. Project No. USGS G898-05.

Descriptors: *Wastewater treatment, Sewage, Biochemical oxygen demand, Microorganisms, Seed cultures, BOD tests, Incubation, Artificial seed cultures, Wastewater.

The use of an artificial seed and elevated temperature was explored as means of increasing the reproducibility and shortening the time of the biochemical oxygen demand (BOD) test. Twenty bacterial strains were evaluated for their ability to grow to high levels in municipal influent sewage and therefore to comprise an artificial seed. Most of the test organisms were gram negative, aerobic, non-fermentative bacteria that were selected for their nutritional versatility and long term survival in dilute aqueous solutions. The few fermentative species included in the test were in the genus Enterobacter and did not compete well with the others. Artificial seeds consisting of 5 or 6 of the most successful strains compared favorably with a natural sludge seed in BOD determinations. The use of 30 C incubation instead of the usual 20 C did not significantly increase the rate of oxygen consumption with either seed type. The artificial seed cultures retained high concentrations of viable cells for 2-3 months in several different simple media, suggesting a stabilized, consistent seed could be maintained in one of these media. (DeCicco-Catholic U.)
W88-03149

ANALYSIS OF ORGANIC POLLUTANTS IN WATER BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY WITH A SWEPT-POTENTIAL ELECTROCHEMICAL DETECTOR,
Georgia Inst. of Tech., Atlanta. School of Chemistry.
P. E. Sturrock.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-164183/AS. Price codes: A03 in paper copy, A01 in microfiche. Report No. ERC 04-85. Environmental Resources Center, Georgia Institute of Technology, Atlanta. August 1985. 34 p, 1 tab, 1 fig, 6 ref. Project No. USGS G-900-06.

Descriptors: *Triazines, *Herbicides, *Pollutant identification, *Chromotography, Electrochemical detection, Carbamates, 2,4-Dinitroaniline.

A new electrochemical detector was investigated for high-performance liquid chromatographic analysis of water for three classes of organic pollutants: carbamte pesticides, 2,4-dinitroaniline herbicides, and triazine pesticides. The detector is a computer-controlled device capable of being programmed to operate in many modes. Rapid-sweep square-wave voltammetry, the preferred mode of operation where applicable, was applied successfully to the triazine pesticides. For these compounds the detector is more sensitive than a uv detector, and the swept mode of operation is useful in resolving components not separated completely by the chromatographic column. For the 2,4-dinitroaniline herbicides, the rapid-sweep square-wave voltam-

metric mode was also successful. However, no clear advantage over the uv detector is evident. For the carbamate pesticides, the swept mode of operation is not suitable because of the slow kinetics for the electron-transfer reactions. However, a DC mode of operation, with extreme potential pulses for electrode cleaning, was very effective. Several of the carbamates detected in this study have not been detected by electrochemical means before. The limits of detection are superior to those reported for uv detectors or other electrochemical detectors. (Sturrock-GA Inst. Tech.)
W88-03156

ARSENIC SPECIATION AND WATER POLLUTION ASSOCIATED WITH MINING IN THE COEUR D'ALENE MINING DISTRICT, IDAHO,
Idaho Univ., Moscow. Dept. of Chemistry.
C. M. Wai, and W. M. Mok.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-153640/AS. Price codes: A04 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute Completion Report, Moscow. October 1985. 67 p, 7 fig, 12 tab, 15 ref, append. Contract No. 14-08-0001-G903. Project No. USGS G903-06.

Descriptors: *Mine wastes, *Acid mine drainage, *Idaho, *Arsenic, Speciation, Water quality.

An arsenic speciation technique has been used to analyze the groundwater systems of a major lead-zinc mine in northern Idaho. The As(III)/As(V) ratio shows a strong correlation with the quality of the mine waters studied, suggesting that it may be used as a chemical indicator for evaluating water pollution problems associated with mine wastes in this area. (Idaho WRRI)
W88-03161

THREE SCREENING TESTS FOR THE EVALUATION OF GROUNDWATER QUALITY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W88-03260

WATER QUALITY MONITORING STRATEGIES,
In-Situ, Inc., Lakewood, CO.
For primary bibliographic entry see Field 7A.
W88-03278

HIGH MOLECULAR WEIGHT HYDROCARBONS IN PARTICULATE MATTER OF THE NORTHWEST GULF OF MEXICO,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
For primary bibliographic entry see Field 5B.
W88-03290

MULTIVARIATE GEOCHEMICAL INVESTIGATION OF TRACE METAL POLLUTION IN KUWAIT MARINE SEDIMENTS,
Kuwait Inst. for Scientific Research, Safat.
For primary bibliographic entry see Field 5B.
W88-03291

USE OF ELLIPSOMETRY TO STUDY OIL FILMS ON THE SEA SURFACE,
Akademiya Nauk SSSR, Leningrad. Inst. Okeanologii.
K. S. Shifrin, Y. V. Villeval'de, and N. P. Petko.
Oceanology ONLGAE, Vol. 26, No. 2, p 187, October 1986. 3 ref.

Descriptors: *Pollutant identification, *Measuring instruments, *Ellipsometry, *Oil pollution, *Fate of pollutants, Oil spills, Oil slicks, Seawater, Polarization, Optical properties, Refractivity, Absorption coefficient, Petroleum products.

Reflective ellipsometry was used to obtain data on the aging of the optical constants of oils and the thickness of oil films on seawater. The method, which involves studying the changes in the polarization characteristics of a beam of light when reflected from the oil film, is attractive because it permits simultaneous determination of three characteristics of the reflecting system: the refractive index, the absorption coefficient, and the thickness of the film. The optical constants of petroleum products and the thickness of petroleum films were determined for five specimen, and the values of the three characteristics agreed with those previously published. An analysis of the data obtained at different angles of incidence showed that the method permits reliable determination of the thickness of an oil film. (Wood-PTT)
W88-03298

TRACE METALS IN SAN FRANCISCO BAY, CALIFORNIA: A PRELIMINARY REPORT,
Geological Survey, Sacramento, CA. Water Resources Div.
S. N. Luoma, P. V. Cascos, and R. Dagovitz.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4170, 1984. 35 p, 7 fig, 6 tab, 55 ref.

Descriptors: *Heavy metals, *Estuaries, *California, *Trace metals, *San Francisco Bay, Water quality, Water pollution, Sediments, Mollusks, San Luis Drain, Corbicula, Suisun Bay.

A 5-month partial study (February to July 1983) was completed in Suisun Bay, a shallow embayment of San Francisco Bay, Calif., to determine characteristic heavy metal concentrations present in sediments and organisms (Corbicula clams) prior to possible discharge of San Luis Drain irrigation tile return water. Preliminary results show sediments are typical of other San Francisco Bay study sites, ranging from coarse sands to fine silt-clays. The sediments are enriched in manganese and low in organic carbon; iron is moderately enriched, with acid-extractable iron concentrations of 162-3,521 micro-g/g. Sediment concentrations of silver, zinc, lead, and cadmium measured between April and July are reported. Previous area studies have shown increased concentrations during autumn and winter, a period not covered in the data set. Due to insufficient data, interpretations are incomplete. Clam-tissue burdens for silver and zinc are similar to those found in Corbicula from pristine areas. Lead concentrations are typically below the 2-micrograms/g detection level. Corbicula do show indications of more tissue enrichment for cadmium and copper at estuarine stations than at riverine stations. (USGS)
W88-03314

DETECTION AND QUANTITATION OF HUMAN ENTERIC VIRUSES IN WASTE WATERS: INCREASED SENSITIVITY USING A HUMAN IMMUNE SERUM GLOBULIN - IMMUNOPEROXIDASE ASSAY ON MA-104 CELLS,
Institut Armand-Frappier, Laval (Quebec). Centre de Recherche en Virologie.
P. Payment, and M. Trudel.
Canadian Journal of Microbiology CJMIAZ, Vol. 33, No. 6, p 568-570, June 1987. 3 fig, 1 tab, 1 ref. NHRDP Program 6602-1842-54.

Descriptors: *Analytical methods, *Enteroviruses, *Wastewater, *Bioasssay, *Bioindicators, *Immunoperoxidase, Enzymes, Cytopathy, Viruses, Effluents.

The most sensitive method for the detection and quantitation of cultivable human enteric viruses in water samples after repassage in the MA-104 cell line is the detection of infected cells by the human immune serum globulin - immunoperoxidase (HISG-IP) method. This immunoperoxidase method is up to 50 times more sensitive than a liquid overlay assay by cytopathic effect in BGM cells. The viral content of waste waters was evaluated with this new methodology. By this method the average viral content of raw sewage (RS) was 900 mpniu/L (most probable number of infectious units per liter), 1056 mpniu/L in primary effluent (PE), and 106 mpniu/L in secondary effluent (SE). With a cytopathic effect assay on BGM cells, values of 85 (RS), 56 (PE), and 2 (SE) mpniu/L were observed, a striking underestimation of the viral content of secondary effluents. (Author's abstract)
W88-03473

ASSESSMENT OF CHEMICAL AND BIOLOGICAL SIGNIFICANCE OF ARSENICAL SPECIES IN THE MAURICE RIVER DRAINAGE BASIN (N.J.). PART I. DISTRIBUTION IN WATER AND RIVER AND LAKE SEDIMENTS,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
S. D. Faust, A. J. Winka, and T. Belton.
Journal of Environmental Science and Health JESEDU, Vol. 22, No. 3, p 209-237, April 1987. 5 fig, 9 tab, 26 ref. N.J. Department of Environmental Protection Grant 4810-100-187030.

Descriptors: *Arsenic, *Maurice River basin, *Sediments, *Water pollution effects, *Path of pollutants, Rivers, Distribution, Pollutant identification, Arsenic compounds, New Jersey, Water pollution sources.

Levels of arsenic were determined in the bottom sediments and waters of the Maurice River, Blackwater Branch, and Union Lake, (N.J.) that were contaminated by a local chemical industry. This was the only known source of the arsenic. Levels of total arsenic in the sediments and waters were determined quarterly over the course of one year. Sediments were extracted for water soluble and total extractable arsenic fractions and partitioned into four species: monomethylarsonic acid (MMAA), dimethylarsinic acid (DMAA), arsenite (As(III)), and arsenate (As(V)). In Union Lake at a shallow sandy sediment site, As(V) predominates. In organic sediments, As (III) or (V) predominate depending upon the dissolved oxygen content of the overlying waters. The oxidation state of the arsenic was affected also by the seasonal lake cycles of stratifying or mixing. (See also W88-03476) (Author's abstract)
W88-03475

ASSESSMENT OF CHEMICAL AND BIOLOGICAL SIGNIFICANCE OF ARSENICAL SPECIES IN THE MAURICE RIVER DRAINAGE BASIN (N.J.). PART II. PARTITIONING OF ARSENIC INTO BOTTOM SEDIMENTS,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
S. D. Faust, A. J. Winka, and T. Belton.
Journal of Environmental Science and Health JESEDU, Vol. 22, No. 3, p 239-262, April 1987. 8 fig, 7 tab, 12 ref. N.J. Department of Environmental Protection Grant 4810-100-187030.

Descriptors: *Union Lake, *Arsenic, *Maurice River basin, *Sediments, *Water pollution effects, *Path of pollutants, Pollutant identification, Rivers, Distribution, Arsenic compounds, New Jersey.

A laboratory study was conducted on the partitioning of four arsenical species onto organic and sandy bottom sediments of Union Lake, N.J. Sandy sediments released more arsenic and sorbed less arsenic than the organic sediments. Organic sediments generally sorbed inorganic As species better than organic As species. (See also W88-03475) (Author's abstract)
W88-03476

ANALYSES OF GROUNDWATER FOR TRACE LEVELS OF PESTICIDES,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
T. L. Lavy, J. D. Mattice, and T. C. Cavalier.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-158219/AS. Price codes: A02 in paper copy, A01 in microfiche. Arkansas Water Resources Research Institute, Fayetteville. Publication No. 118, September 1985. 17 p, 5 tab. Contract No. 14-08-0001-G893. Project No. USGS G893-02.

Descriptors: *Arkansas, *Groundwater pollution, *Pesticides, Irrigation water, Alachlor, Atrazine, Cyanazine, Diuron, Fluometuron, Linuron, Metolachlor, Propanil.

Agricultural production is a major source of revenue in Arkansas, In order to increase productivity, it has been necessary to rely increasingly on the use of pesticides and irrigation water. In the last 15 years several states have reported finding pesticides in groundwater as a result of normal agricultural practices. Since almost half of the population also relies on groundwater as their source of drinking water, it is necessary to conduct research to ascertain the presence or absence of commonly used pesticides in groundwater. Multiresidue analytical techniques were developed for the analysis of acifluorfen, alachlor, atrazine, cyanazine, diuron, fluometuron, linuron, metolachlor and propanil from groundwater, by either GLC or HPLC. Analytical sensitivities ranged from 1 to 10 ppb. Groundwater samples were collected from three areas of southeastern Arkansas that are under heavy agricultural production. Samples were collected directly from irrigation wells just prior to and during the peak of the irrigation season and will be compared to determine whether any temporal differences exist. To-date, over 300 samples have been analyzed. No positive finding for any pesticide has been shown. (Lavy-WRRC-University of Arkansas, Fayetteville)
W88-03489

5B. Sources Of Pollution

IMPACT OF URBANIZATION ON MAJOR ION FLUX THROUGH CATCHMENTS: A CASE STUDY IN SOUTHERN ENGLAND,
Southern Illinois Univ., Carbondale. Dept. of Geography.
For primary bibliographic entry see Field 4C.
W88-02493

ORGANOCHLORINE INSECTICIDE RESIDUES IN THE RAIN WATER IN DELHI, INDIA,
Delhi Univ. (India). Dept. of Zoology.
H. C. Agarwal, C. P. Kaushik, and M. K. K. Pillai.
Water, Air, and Soil Pollution WAPLAC, Vol. 32, No. 3/4, p 293-302, February 1987. 5 fig, 3 tab, 17 ref.

Descriptors: *Path of pollutants, *Rainfall, *Organochlorine compounds, *Insecticides, *Pesticides, Organic compounds, Water analysis, India.

Rain water samples were regularly collected from three sites, namely, Netaji Nagar, Moti Nagar and Town Hall within the Delhi city area from July, 1980 to June, 1982. The pesticide residues were adsorbed on polyurethane foam coated with 0.5% DC-200 and subsequently extracted and analyzed for DDT, HCH and their metabolites/isomers. The concentration of total DDT ranged from 0.22 to 108 microgram(ug)/L with a mean value of 12.5 ug/L. The samples of rain water contained varying levels of 4,4-DDT, 2,4-DDT, 4,4-DDE, and 4,4-DDD. The 4,4-DDT, 4,4-DDE and 2,4-DDT were the main components of total DDT. The range of HCH residues in rain water was from 0.08 to 43 ug/L with a mean of 5.3 ug/L. The residues of HCH consisted mainly of alpha- and gamma-isomers with traces of beta- and delta-isomers. The alpha- and gamma-isomers accounted for 76 and 24% of total HCH, respectively. The concentrations of DDT and HCH in rain water were generally less than 10 ug/L and exceeded 10 in only 4 and 3 cases, respectively. The residues of these insecticides were generally higher during October to December. Residues of DDT were higher at Moti Nagar which is near a DDT factory. Residues of HCH were maximum at Town Hall, a commercial area of the city. (Author's abstract)
W88-02494

MODELS FOR TETRACYCLINE IN AQUATIC ENVIRONMENTS: I. INTERACTION WITH BENTONITE CLAY SYSTEMS,
Dalhousie Univ., Halifax (Nova Scotia). Trace Analysis Research Centre.
B. B. Sithole, and R. D. Guy.
Water, Air, and Soil Pollution WAPLAC, Vol. 32, No. 3/4, p 303-314, February 1987. 7 fig, 1 tab, 19 ref.

Descriptors: *Path of pollutants, *Clays, *Adsorption, *Tetracycline, Bentonite, Model studies, Isotherms, Substrates.

The interactions of tetracycline with model clay adsorbents has been studied as a function of suspension pH, ionic strength, and adsorbate concentration. The model clay adsorbents were the Na, Ca, and dodecytrimethylammonium forms of bentonite and a tannic acid covered bentonite. The adsorption isotherms were of the Langmuir type and the adsorption capacity decreases in the order tannic acid-clay > Ca-clay > Na-clay dodecyltrimethylammonium-clay. The adsorption onto the clay substrates decreases as the ionic strength and pH increases. (See also W88-02496) (Author's abstract)
W88-02495

MODELS FOR TETRACYCLINE IN AQUATIC ENVIRONMENTS: II. INTERACTION WITH HUMIC SUBSTANCES,
Dalhousie Univ., Halifax (Nova Scotia). Trace Analysis Research Centre.
B. B. Sithole, and R. D. Guy.
Water, Air, and Soil Pollution WAPLAC, Vol. 32, No. 3/4, p 315-321, February 1987. 5 fig, 7 ref.

Descriptors: *Humic acids, *Path of pollutants, *Clays, *Adsorption, *Tetracycline, Bentonite, Model studies, Isotherms, Substrates.

The adsorption of tetracycline onto humic acid and peat has been found to obey the Freundlich and Scatchard plot models. The latter model showed that the adsorption was biphasic in nature thus indicating the presence of two types of binding sites on the organic matter. The adsorption was reduced at high ionic strength and pH. (See also W88-02495) (Author's abstract)
W88-02496

SOURCE OF PB, CU, AND ZN IN FOGWATER,
California State Univ.-Stanislaus, Turlock. Dept. of Chemistry.
D. R. Miller, J. E. Byrd, and M. J. Perona.
Water, Air, and Soil Pollution WAPLAC, Vol. 32, No. 3/4, p 329-340, February 1987. 4 fig, 3 tab, 23 ref.

Descriptors: *Water pollution sources, *Fogwater, *Heavy metals, *Air pollution, Rural areas, Voltammetry, California, Zinc, Lead, Copper, Ions.

The variation in the concentrations of Zn, Pb, and Cu in water and acid extracts of airborne particulates and in fogwater collected in the rural northern San Joaquin Valley of California during the fall and winter of 1983-1984 was determined by anodic stripping voltammetry. There is a good correlation between water extracts of airborne particulates and fogwater for the concentrations of Cu and Pb and the concentration ratio (Cu/Pb), suggesting that the concentrations of these metals in fogwater is controlled by the concentration of extractable metal in the particulates on which the fog droplet forms. The major ion composition of the fogwater samples was measured by ion chromatography and compared with literature values for urban fogwater. (Author's abstract)
W88-02497

INDICATOR BACTERIA CONCENTRATIONS AS AFFECTED BY HYDROLOGIC VARIABLES IN THE APALACHICOLA RIVER, FLORIDA,
Geological Survey, Tallahassee, FL.
J. F. Elder.
Water, Air, and Soil Pollution WAPLAC, Vol. 32, No. 3/4, p 407-416, February 1987. 6 fig, 1 tab, 17 ref.

Descriptors: *Model studies, *Water pollution sources, *Bacteria, *Coliforms, *Rivers, *Hydrology, Monitoring, Transport, Food chain, Floods.

Concentrations of fecal coliform and fecal Streptococcus bacteria were monitored in the Apalachicola River, Florida, at various river stages. Bacteria transported by the river may eventually be assimilated by estuarine filter feeders, including shellfish. Sources along the river contributed to relatively high coliform and coliform:Streptococcus ratios at a few sites upstream, but there was a general decreasing trend in coliform numbers in a downstream direction. The data suggested that coliform densities depend not only on discharge, but also on factors such as whether the river stage is rising or falling, whether the flood is in an early or late phase, and the volume of the current peak relative to earlier peaks. A regression model indicated that 53% of fecal coliform variability could be accounted for by river discharge and 32% could be accounted for by other hydrologic characteristics of the flood. (Author's abstract)
W88-02501

SEDIMENTATION AND EFFLUENT CONCENTRATION OF SOFT CLAY ON RECLAMATION WORKS,
Japan Bottom Sediment Management Association, Tokyo.
For primary bibliographic entry see Field 2J.
W88-02516

COMMENCEMENT BAY - A REMEDIAL INVESTIGATION OF CONTAMINATED SEDIMENTS IN A MARINE ENVIRONMENT,
Washington State Dept. of Ecology, Olympia.
J. D. Krull, T. C. Ginn, and R. C. Barrick.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 48-64, 4 fig, 2 tab, 4 ref.

Descriptors: *Path of pollutants, *Water pollution effects, *Water pollution sources, *Marine environment, *Commencement Bay, *Sedimentation, Tissue analysis, Bioassays, Toxicity, Bioaccumulation, Toxicity, Fate of pollutants, Dredging.

Contamination of sediments in Commencement Bay, Washington by toxic pollutants has caused considerable concern about degradation of marine habitats, induction of disease in indigenous organisms, and contamination of organism tissues. The approach to and results of an intensive 2-year, $2 million investigation are presented. The goals of the investigation were to determine the extent of contamination, determine if the contamination resulted in adverse effects to public health or the environment, identify problem contaminants and their sources, and identify potential remedial actions. An extensive synoptic data set was obtained during the investigation. These chemical, toxicity (bioassays), and biological effects (benthic community structure, bioaccumulation, fish histopathoIoyg) indicators were used along with historical data to identify problem areas and problem contaminants. Sources of problem contaminants were identified to the extent possible using horizontal and vertical patterns of chemical contamination, available source loading data, information on dredging history, knowledge of environmental fate processes, and knowledge of past and present industrial activities in the area. Problem areas, problem contaminants, and contaminant sources were prioritized such that resources could be effectively allocated for corrective actions. (See also W88-02513) (Author's abstract)
W88-02517

CONTAMINANT MOBILITY AND ENGINEERING DESIGN AT A NEARSHORE CONFINED DISPOSAL SITE -- PORT OF SEATTLE TERMINAL 91 SHORT FILL,
Port of Seattle, WA.
For primary bibliographic entry see Field 5E.
W88-02518

DEVELOPMENT OF LEACHATE TESTING PROTOCOLS FOR DISPOSAL OF CONTAMINATED SEDIMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
T. E. Myers, J. M. Brannon, and D. M. Griffin.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./

Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 149-157, 4 fig, 2 tab, 2 ref.

Descriptors: *Leachates, *Path of pollutants, *Waste disposal, *Analytical methods, *Contaminated sediments, *Water quality, Monitoring, Mathematical studies, Effluents, Advection, Dispersion, Equilibrium, Pore water, Bulk density, Sediments.

A testing protocol is described for evaluating desorption characteristics of contaminants from dredged material. The procedure relies on comparing the effluent trace predicted by the one-dimensional advection-dispersion equation containing an equilibrium source term with that from an operating laboratory column. System specific parameters (pore water velocity, sediment bulk density, volumetric water content of sediment, bulk dispersion coefficient for contaminant, slope of desorption isotherm) required to solve the transport equation are evaluated separately. Such comparisons provide insight into the mechanisms responsible for contaminant desorption. The procedure was applied to a highly contaminated sediment from Indiana Harbor, Indiana. The integrated approach appears to be a useful tool for characterizing the process that governs contaminant leaching from sediment solids. Preliminary results suggest that leaching of arsenic and cadmium from Indiana Harbor sediment is governed by an oil and grease film rather than equilibrium partitioning between the sediment and aqueous phase. (See also W88-02513) (Lantz-PTT)
W88-02522

METHOD FOR ESTIMATION OF METHYLMERCURY DISSOLVED INTO WATER FROM DREDGED MATERIAL BY USING THE MARINE COPEPOD ACARTIA CLAUSI,
Kumamoto Univ. (Japan).
For primary bibliographic entry see Field 5A.
W88-02523

GROUND WATER QUALITY.
For primary bibliographic entry see Field 5G.
W88-02533

OVERVIEW OF CONTAMINANTS IN GROUND WATER,
Rijksinstituut voor de Volksgezondheid en Milieuhygiene, Leidschendam (Netherlands).
B. C. J. Zoeteman.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 27-38, 1 fig, 6 tab, 23 ref.

Descriptors: *Water pollution sources, *Groundwater pollution, *Groundwater quality, Soil contamination, Research priorities, Path of pollutants, Metals, Pollutant identification, Odor, Microbiological studies, Organic compounds, Mathematical models.

Increased research activities in the field of groundwater pollution have resulted in a recent growing awareness of the large number of cases of soil contamination. It seems that only very recently the total magnitude and impact of the worldwide soil pollution problem is becoming visible. To deal with these soil problems, research programs and legislative instruments similar to those developed during the last decade for water contamination problems are needed. After the present phase of collecting data on the occurrence of chemicals in soil and groundwater and on the sources of contamination, the next step inevitably is to answer the question of which cases need to be handled with the highest priority and for what reasons. To understand these reasons, a better insight into the possible effects of soil contamination on the soil ecosystem and on public health has to be developed in conjunction with methods to predict the transport and behavior of groundwater contaminants. Research in the area of the occurrence of soil and groundwater contamination should focus on: (1) metal speciation; (2) identification and quantification of more polar, halogenated contaminants which escape present analytical methods; and (3) application of overall-effect-detecting techniques such as odor assessment and mutagenicity screening tests, on the basis of which advanced analytical techniques can be used to identify the compounds of greatest concern. Research in the area of transport and transformation is needed on areas such as: (1) microbial degradation of organic chemicals under aerobic and anaerobic conditions; (2) production of metabolites (e.g., from certain pesticides); and (3) prediction techniques, based on mathematical models for the half-life and/or retardation factor of chemicals introduced with the infiltrating rain water or surface water into the soil. (See also W88-02533) (Lantz-PTT)
W88-02535

CHEMICAL CONTAMINATION OF GROUND WATER,
Geraghty and Miller, Inc., Syosset, NY.
D. W. Miller.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 39-52, 13 fig, 9 ref.

Descriptors: *Groundwater pollution, *Path of pollutants, *Chemical contamination, Geohydrology, Aquifers, Groundwater quality.

Most groundwater contamination incidents are local, and affect only the uppermost aquifers. The area over which groundwater quality is significantly degraded is typically less than a mile long and one-half mile wide, with pollutants moving at an average rate of less than 1 ft/day. On the other hand, the resource itself is huge. At almost any location, groundwater can provide a supply sufficient for single-family domestic use, and more than one-third of the nation is underlain by aquifers capable of yielding at least 100,000 gal/day to an individual well. Although the specific volume of contaminated groundwater may be only a very small percentage of the nation's groundwater resource, the impact of this contamination can be very large. There is a critical need to identify and manage contamination sites both from the standpoint of protecting public health and preserving the resource. The geohydrology of groundwater pollution is discussed and problems with this type of investigation are presented. (See also W88-02533) (Lantz-PTT)
W88-02536

MICROBIAL CONTAMINATION OF THE SUBSURFACE,
Arizona Univ., Tucson. Dept. of Microbiology.
C. P. Gerba.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 53-67, 8 tab, 43 ref.

Descriptors: *Microbiological studies, *Groundwater pollution, *Water pollution sources, Bacteria, Viruses, Campylobacter, Yersinia, Path of pollutants, Rainfall, Microorganisms.

Current information on bacterial indicators and potentially pathogenic microorganisms in groundwater is limited. More is currently known about the bacteriological quality of groundwater than of its virological quality, but there are still areas in need of further research. Rainfall events appear to play a key role in the transport of both bacteria and viruses in the subsurface, and detailed studies are needed to define the significance of these events on long term groundwater quality. Results of previous surveys on the bacteriological quality of groundwater indicate that viral pollution is more widespread than might be supposed. Furthermore, many of the previous systems used for virus concentration had efficiencies of 2-3% and were limited to the detection of enteroviruses. Now, however, systems with efficiencies of 30% and greater are available. Viruses are known to enter groundwater under certain conditions, but these conditions have not been adequately defined. It is not yet possible to determine exactly what factors affect the retention and mobility of viruses in soils. Such an understanding is essential so that predictions may be made and methods developed for estimating virus migration. The current body of information on the occurrence of viruses in groundwater is too limited to develop guidelines on safe distances between waste sources and drinking water wells. Field studies are sorely needed to define such guidelines. The last decade has seen major developments in technology for virus detection in water, and it would appear time to apply this technology to answer some of the major questions concerning viral contamination of groundwater. (See also W88-02533) (Lantz-PTT)
W88-02537

EFFECTS OF LOCAL SOURCES OF POLLUTION ON GROUND WATER QUALITY IN THE NETHERLANDS,
Rijksinstituut voor de Volksgezondheid en Milieuhygiene, Leidschendam (Netherlands).
W. Duijvenbooden.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 68-93, 17 fig, 15 tab, 13 ref.

Descriptors: *Water pollution sources, *Groundwater pollution, *Groundwater quality, *Netherlands, Path of pollutants, Hydrocarbons, Pesticides, Phenols, Aquifers, Organic compounds, Heavy metals.

This chapter discusses the effects of local sources of pollutants on groundwater quality in The Netherlands. The risk of groundwater pollution is strongly influenced by hydrogeological conditions. About 35% of all groundwater pumping stations in The Netherlands withdraw water from phreatic aquifers. Another 35% withdraw water from shallow aquifers covered by layers of low permeability. Human activities and sandy spots frequently increase the permeability of the layers covering shallow aquifers. Hence, layers of low permeability do not guarantee the protection of underlying aquifers against pollution. It appears that only about 30% of the 250 groundwater pumping stations in The Netherlands can be characterized as relatively safe against pollution in the short term; most of the pumping stations may be influenced over the long term. Taking into account that about 80% of the nearly 1000 million cu m of tap water supplied each year by public water supplies is derived from groundwater, it is clear that the presence of hundreds of local sources of pollution in the catchment and even protected areas of groundwater pumping stations is of utmost concern. Some of these pollutants are: (1) aromatic hydrocarbons; (2) phenols; (3) heavy metals; and (4) pesticides. Remedial action is needed to prevent unacceptable groundwater pumping stations will be required. Detailed knowledge of local flow patterns of groundwater and a more or less complete inventory of all local sources of contamination in the catchment areas are necessary. (See also W88-02533) (Lantz-PTT)
W88-02538

REDOX REACTIONS, MINERAL EQUILIBRIA, AND GROUND WATER QUALITY IN NEW ZEALAND AQUIFERS,
Department of Scientific and Industrial Research, Petone (New Zealand). Chemistry Div.
C. J. Downes.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 94-121, 6 fig, 4 tab, 19 ref.

Descriptors: *Groundwater quality, *New Zealand, *Chemical reactions, *Saline water intrusion, *Geochemistry, *Coastal aquifers, *Karst, *Groundwater pollution, *Water quality, *Oxidation-reduction reactions, Equilibrium, Minerals, Hutt Valley, Takaha Valley, Aquifers, Gravel aquifers, Chemical analysis.

The variations in the water quality characteristics for two New Zealand aquifers are the result of natural processes. The first study, is an investigation of changes in quality of the Hutt Valley groundwaters arising from rock-water interactions and oxidation-reduction reactions as the water passes from the recharge to the discharge zone of this greywacke gravel aquifer. A wider range of oxidation-reduction conditions was encountered in this system than in the few reported studies where a similar approach has been adopted. In the past, undesirable features such as high levels of dissolved iron, or the corrosivity of water from a particular bore, have usually been considered as isolated chemical problems. An appreciation of the

chemistry of a water in terms of the oxidation-reduction sequence, in combination with the hydrology, is important in deciding on the strategy required for the exploitation and management of a groundwater resource. For instance, such as an approach allows predictions to be made of possible changes in water quality that would result from increased abstraction rates or relocation of major abstraction points. Knowledge of the oxidation-reduction conditions is likely to be required to interpret chemical transformations in polluted aquifers. The second study, of the Takaha Valley groundwater, is an investigation of the sea water intrusion into a coastal karst aquifer and the unexpected variation of the extent of this intrusion with changes in the flow of the Waikoropupu Springs, the only on-shore discharge point for this groundwater system. (See also W88-02533) (Lantz-PTT)
W88-02539

BEHAVIOR OF ORGANIC POLLUTANTS IN PRETREATED RHINE WATER DURING DUNE INFILTRATION,
Rijksinstituut voor de Volksgezondheid en Milieuhygiene, Leidschendam (Netherlands).
G. J. Piet, and J. G. M. M. Smeenk.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 122-144, 15 fig, 8 tab, 23 ref.

Descriptors: *Organic compounds, *Rhine River, *Dunes, *Infiltration, *Groundwater quality, *Path of pollutants, Aquifers, Groundwater recharge, Trichloroethene, Tetrachloroethene, Tetrachloromethane, Chlorophosphates, Chloroanilines, Chlorotoluidines, Soil contamination, Water quality.

Organic substances were measured in a dune aquifer after induced recharge using treated Rhine water. In 1978, it was observed that a variety of industrial chemicals such as trichloroethene, tetrachloroethene, tetrachloromethane, bis(2-chloroisopropyl)ether, chlorophosphates, were small amounts of chloroanilines and chlorotoluidines are present in water after bank infiltration, even after residence times in the soil of several years. In later studies other volatile organic chlorine compounds such as 1,2-dichloroethane have been detected. Ongoing bank infiltration of Rhine water caused a slowly moving zone of odor-intensive compounds in the aquifer. Industrial organic compounds present in the river Rhine have been detected in drinking-water of The Netherlands when this water has been used as a raw water source. For these reasons more attention has been paid to industrial organic compounds in the aquifers of sites used for artificial recharge. It is evident that many processes in the soil affect organic compounds. These processes can vary with the seasons. The infiltrated water and the soil play a role, but the effect of a variety of microorganisms under aerobic and anaerobic conditions in the soil should not be underestimated. A field study in the dunes of the province of North-Holland was set up to get more information on the behavior of chemicals that might endanger soil and drinking-water quality and to identify the dominant processes taking place during infiltration. A major aspect is the evaluation of differences in water quality under aerobic and anaerobic conditions as a function of the residence time. In this paper, the results of this orientation are reported. (See also W88-02533) (Lantz-PTT)
W88-02540

EFFECTS OF DISCHARGING A PRIMARY SEWAGE EFFLUENT ON THE TRIASSIC SANDSTONE AQUIFER AT A SITE IN THE ENGLISH WEST MIDLANDS,
Water Research Centre, Medmenham (England). Medmenham Lab.
K. M. Baxter.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 145-187, 20 fig, 14 tab, 15 ref.

Descriptors: *Wastewater discharge, *Aquifers, *England, *Water pollution effects, *Groundwater quality, *Effluents, *Path of pollutants, *Groundwater pollution, Sandstone, Groundwater recharge, Geohydrology, Irrigation, Wastewater disposal, Infiltration.

The discharge of sewage and sewage effluents directly to the ground as a means of disposal is widespread within the United Kingdom. The environmental impact of such disposal has become increasingly troublesome in recent years, and as a result of this concern the Water Research Centre (WRC) has been conducting a research program since 1976 to investigate the effects of recharging sewage effluents to the Cretaceous Chalk and Triassic Sandstone aquifers at six sites in the United Kingdom. It has been estimated that about 150,000 cu m/day of effluent is discharged into the Chalk, 42,000 cu m/day into the Triassic Sandstones, and 22,000 cu m/day into minor aquifers such as glacial-fluvial gravels. Some conclusions and recommendations from this research are: (1) There is good agreement between lithological and geophysical logging, both in determining geological boundaries and in identifying hydrogeologically significant zones; (2) Physicochemical processes operating in the unsaturated zone affect the removal of nitrogen, phosphorus, heavy metals and microbes; (3) Flow along fractures and bedding planes has been found to be of importance in determining the pattern of contamination above and below the water table; (4) Beneath the irrigated area, groundwater contains a very high proportion of effluent down to over 120 m below surface. The groundwater is contaminated by effluent to a radius of several kilometers, this contaminated zone being 50 m thick at 1.5 km radius; (5) As the effluent moves further from the site of disposal, mixing with native groundwater is the main mechanism of quality improvement; (6) Whole-rock analysis has shown that effluent infiltration through the unsaturated zone has substantially leached calcite while enriching the rubidium, barium, and zirconium concentrations; and (7) The results of the research at this site indicate that if properly managed such sewage disposal methods considerably improve the quality of the recharged effluent and also conserve groundwater resources. (See also W88-02533) (Lantz-PTT)
W88-02541

LAND APPLICATION OF MUNICIPAL WASTE WATER,
National Center for Ground Water Research, Norman, OK.
For primary bibliographic entry see Field 5E.
W88-02542

METHODS FOR THE ASSESSMENT OF GROUND WATER POLLUTION POTENTIAL,
National Center for Ground Water Research, Norman, OK.
For primary bibliographic entry see Field 7A.
W88-02545

MICROCOSM FOR GROUND WATER RESEARCH,
National Center for Ground Water Research, Norman, OK.
G. Bengtsson.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 330-341, 4 fig, 4 tab, 5 ref.

Descriptors: *Groundwater quality, *Model studies, *Aquatic ecosystems, *Water analysis, Ecosystems, Biological studies, Laboratories, Path of pollutants, Fate of pollutants.

A microcosm may be defined as any part of an ecosystem that may be subject to laboratory control due to its reduction in size or complexity. The feedback between processes in the physical model, or microcosm, and a mathematical model, which may be used to predict the behavior of a large physical system, is important. The microcosm can be a mere simulation of some greater physical system, or it can serve to estimate parameters that may be used in mathematical equations that predict the behavior of the greater physical system. Microcosms have been used to address several levels of biological complexity - including cellular, tissue, organ, organismal, population, community, and ecosystem - to assess chemical transport, fate, and effects. Three critical problems have been identified in connection with the use of microcosms. First is the problem of realism, the difficulty of applying results obtained in simplified systems to complex natural environments. Second, is the problem of reproducibility, the lack of information on the comparability of data from microcosms of different size and structure. Last is the problem of replicability, the difficulty of estimating confidence limits on parameters measured in microcosms. The microcosm described in this paper was constructed primarily for studies pertaining to transport and fate of pollutants in groundwater, but it also has utility for investigation of the response of the subsurface biological community to environmental perturbations. (See also W88-02533) (Lantz-PTT)
W88-02547

SUBSURFACE CHARACTERIZATION IN RELATION TO GROUND WATER POLLUTION,
Water Research Centre, Medmenham (England). Medmenham Lab.
C. P. Young.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 348-355, 50 ref.

Descriptors: *Groundwater quality, *Groundwater pollution, Physical analysis, Chemical analysis, Microbiological studies, Radioisotopes, Groundwater movement, Saturation, Aquifers.

Simple descriptions of aquifer systems, often defined only in terms of bulk hydraulic conductivity, broad classifications of lithologic, and general hydraulic gradients, are not sufficient to define the physical, geochemical, and microbial systems which control the propagation and attenuation of contaminants. Interest in the capacity of unsaturated zones to attenuate pollutants has given rise to more detailed investigation of the pore size distributions and of unsaturated hydraulic conductivities, with measurements of physicochemical properties such as self-diffusion coefficients of specific solutes through porous media and estimations of partition coefficients for particular pollutants with respect to different aquifer materials. The relationship between fissure and matrix flow has received much attention. The age of groundwaters has been estimated from their content of radioisotopes such as tritium (3-H) and 14-C and from the ratio of stable isotopes such as 16-O and 18-O. The measurement of inert gases He and Rn has recently been investigated as a tool for dating certain groundwaters. The importance of rock-water interactions and the chemical equilibrium status of the groundwater has encouraged not only more complete analyses of the fluid phase, with measurements of the redox-potential, but also detailed identification of the minerals forming the aquifer matrix. The possibility that microbial transformations may modify significantly groundwater chemistry within the aquifer itself has led to studies of the distribution of bacterial populations and of substrates they may colonize in aquifers. (See also W88-02533) (Lantz-PTT)
W88-02548

STRATEGY FOR SUBSURFACE CHARACTERIZATION RESEARCH,
Oklahoma State Univ., Stillwater. Dept. of Geology.
A. W. Hounslow.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 356-369, 4 fig, 6 ref.

Descriptors: *Groundwater quality, *Groundwater pollution, *Path of pollutants, Fate of pollutants, Geohydrology, Mineralogy, Geochemistry, Biological studies, Kinetics, Mass transport.

The ultimate aim of subsurface study is to develop definitive information concerning the behavior of contaminants in subsurface environments in order to provide a valid scientific basis for protection of groundwater quality. The three basic aspects of this type of study are: (1) The prediction of the impact on groundwater quality of contaminants in the environment; (2) The optimization of existing conditions so as to enhance the attenuating biotic or abiotic processes affecting contaminants in subsurface environments; and (3) The development of cost-effective methods of rehabilitating contaminated aquifers. The second and third aspects of

such a study must to a great extent await the results of the first part. The successful prediction of the transport of contaminants in the subsurface requires an understanding of the interactions between the pollutant and the soil or other subsurface geological materials. Hydrogeologic mineralogical, geochemical, and biological parameters, mass transport processes, and biotic kinetic processes are all determinations which should be made in the characterization process. (See also W88-02533) (Lantz-PTT)
W88-02549

INTERACTION BETWEEN ORGANIC MOLECULES AND MINERAL SURFACES,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
M. M. Mortland.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 370-386, 37 ref.

Descriptors: *Groundwater chemistry, *Chemical reactions, *Organic compounds, *Minerals, *Path of pollutants, Adsorption, Solute transport, Molecular structure, Bacteria, Viruses.

Organic molecules may be adsorbed by minerals through a variety of interactions of varying energy or not adsorbed at all. Whether an organic species is adsorbed depends upon its structure and chemistry as well as the nature of the surfaces. Water content may be an important factor affecting adsorption of some molecules. The consequences of adsorption include a reduction of the rate of movement of the particular organic species through soil or sediments. Extremely strong adsorption may render the molecule essentially immobile while weak adsorption results in a short residence time on the surface and merely a delay in its movement with soil or groundwater. Biological agents such as bacteria and viruses interact with minerals to the extent that their concentration in the water phase may be very low compared with that in the particulate phase. In addition, such complexation may protect the biological agent and provide an environmental beneficial to its preservation and growth. In some cases, catalytic alteration of an organic species may occur after adsorption on a mineral surface. (See also W88-02533) (Lantz-PTT)
W88-02550

ADVECTION-DISPERSION-SORPTION MODELS FOR SIMULATING THE TRANSPORT OF ORGANIC CONTAMINANTS,
Stanford Univ., CA. Terman Engineering Center.
P. V. Roberts, M. Reinhard, G. D. Hopkins, and R. S. Summers.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 425-445, 9 fig, 4 tab, 28 ref. EPA Grant No. R-804431.

Descriptors: *Advection, *Dispersion, *Sorption, *Model studies, *Path of pollutants, *Organic compounds, Hazardous wastes, Mathematical models, Tracers, Solute transport.

Pollution of groundwater by persistent and potentially hazardous organic chemicals has begun to attract attention as a national problem of grave concern. To deal with this emerging problem, it will be necessary to develop and employ mathematical models to simulate the transport of such chemicals in order to plan and interpret field studies. For these purposes, the models employed preferably should be computationally simple, require a less than inordinate amount of input data, and provide output sufficiently accurate to improve our knowledge of the behavior of the contaminants in question. This paper describes the types of simple models available to assess their potential and limitations, and to illustrate their use by applying them to interpret a body of data obtained in a field study of artificial recharge. There is ample evidence that organic trace contaminants interact with soil solids during artificial recharge. Sorption serves to retard solute transport, whereas both sorption and dispersion attenuate concentration fluctuations. Advection and dispersion in the subsurface cannot be predicted accurately based on theory or laboratory experiment, but must be measured by means of tracer experiments in the field. Sorption can be predicted with order-of-magnitude accuracy based on knowledge of the octanol-water partitioning of the solute and the organic carbon content of the aquifer material. The combined effect of sorption and dispersion can be simulated satisfactorily if the retardation factor and the dispersivity can be estimated reliably. Stimulus-response experiments can provide useful information regarding the behavior of organic solutes in the subsurface environment. The hydrophobic interactions of solutes with water appear to have a central significant in determining behavior of those solutes in subsurface transport. As a general rule, hazardous, nondegradable organic chemicals that are only weakly hydrophobic appear to pose the most serious threats of widespread groundwater contamination. (See also W88-02533) (Lantz-PTT)
W88-02553

BEHAVIOR AND FATE OF HALOGENATED HYDROCARBONS IN GROUND WATER,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
R. P. Schwarzenbach, and W. Giger.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 446-471, 8 fig, 7 tab, 46 ref.

Descriptors: *Fate of pollutants, *Hydrocarbons, *Groundwater pollution, *Path of pollutants, Halogenated hydrocarbons, Organic carbon, Sorption, Sulfur compounds, Biotransformation.

Halogenated hydrocarbons are among the most ubiquitous groundwater pollutants. The major causes for groundwater contamination by such chemicals include leachates from chemical waste dumps, spills, polluted surface waters, and use of the chemicals. The degree of sorption of a given halogenated hydrocarbon by soil and aquifer materials can be calculated from the organic carbon content of the natural sorbent and from the octanol-water partition coefficient of the compound. Many halogenated hydrocarbons (e.g., halogenated olefins, halogenated benzenes, polyhalogenated alkanes) are quite resistant to chemicals transformations in groundwater. Monohalogenated alkanes undergo hydrolysis and elimination reactions with half-lives between a few seconds and a year. Under anaerobic conditions in the presence of hydrogen sulfide, primary alkylhalides can react with HS(-) to yield sulfur-containing compounds such as alkylmercaptans and dialkylsulfides. Polyhalogenated methanes can probably react with HS(-) but by a different reaction mechanism involving an electron transfer reaction. Presently, very little is known about biological transformations of halogenated hydrocarbons in the ground. From field observations one can conclude that many of these chemicals are quite resistant to biotransformation. (See also W88-02533) (Lantz-PTT)
W88-02554

SURVIVAL AND TRANSPORT OF PATHOGENIC BACTERIA AND VIRUSES IN GROUND WATER,
Kiel Univ. (Germany, F.R.). Geologisch-Palaeontologisches Inst. und Museum.
G. Matthess, and A. Pekdeger.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 472-482, 4 fig, 1 tab, 15 ref.

Descriptors: *Fate of pollutants, *Pathogenic bacteria, *Viruses, *Path of pollutants, *Groundwater pollution, Groundwater quality, Water pollution sources, Municipal wastewater, Drinking water, Filtration, Flocculation, Aggregation, River bank filtration, Sand filtration.

For the assessment of groundwater protection against pathogenic microorganisms (bacteria and viruses), the mechanisms which control the two main factors for their elimination in the aquifer must be studied: (1) The persistence of bacteria and viruses under the biological and chemical conditions of the groundwater, and (2) The physical and physical-chemical processes that control the transport of microorganisms in groundwater. The groundwater may be contaminated by sewage containing the excrements of carriers or diseased persons. In municipal sewage, the concentration of E. coli is of the order to 1,000,000 to 10,000,000/mL and in surface waters about 1,000 and 10,000/mL. In Central European rivers usually 1-3 Salmonella/L are detected. The virus concentrations in the U.S. are as high as 1,000 to 100,000 PFU/L in sewage effluent, 10 to 10,000/L in treated sewage effluent, and 0 to 1,000/L in surface waters (PFU = plaque forming units). According to the EPA, drinking water that has undergone conventional treatment would contain about 1 infectious unit per 1,000,000 to 10 to the 8th power L. The purifying characteristics of river bank filtration and slow sand filtration can be only partly compared with the processes in groundwater. The biologically active layer at the boundary of water and sediment is very effective due to the high content of sorptive small particles and microbial slimes. If this layer is destroyed, bacteria and virus transport may take place, contaminating the aquifer. It needs a certain time to build up this layer again (few days to few weeks). Disturbances such as erosion or drying lead to a breakthrough into the deeper layers that will decrease after some time. During a continuous contamination of the groundwater by organic substances and microorganisms, the contamination plume becomes smaller with time. At very high bacteria concentrations flocculation and aggregation can occur at the source of contamination so that only a limited transport into the aquifer can take place. (See also W88-02533) (Lantz-PTT)
W88-02555

BIODEGRADATION OF CONTAMINANTS IN THE SUBSURFACE,
Robert S. Kerr Environmental Research Lab., Ada, OK.
J. T. Wilson, M. J. Noonan, and J. F. McNabb.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 483-492, 6 fig, 2 tab, 7 ref.

Descriptors: *Fate of pollutants, *Biodegradation, *Groundwater pollution, Aquifers, Microorganisms, Biotransformation, Organic compounds, Toluene, Chlorobenzene, Halogenated hydrocarbons, Aeration zone, Saturation zone.

The deeper regions of the unsaturated subsurface and shallow regions of water table aquifers may harbor a microflora which can transform some, but not all, of the organic pollutants commonly encountered in the subsurface environment. Biodegradation of toluene and chlorobenzene was highly variable between sampling sites, even though these compounds are generally degraded in surface materials. This suggests that biodegradation in the subsurface should not be predicted from the behavior of compounds in material from the surface but must be verified by direct experiment for each compound and each site of interest. In this study, low concentrations of most halogenated hydrocarbons did not undergo detectable biotransformation in subsurface matrix material obtained from both unsaturated and saturated zones at three different sites. (See also W88-02533) (Lantz-PTT)
W88-02556

ANAEROBIC TRANSFORMATION, TRANSPORT, AND REMOVAL OF VOLATILE CHLORINATED ORGANICS IN GROUND WATER,
Florida International Univ., Miami. School of Technology.
P. R. Wood, R. F. Lang, and I. L. Payan.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 493-511, 12 fig, 6 tab, 3 ref.

Descriptors: *Aerobic zone, *Biotransformation, *Path of pollutants, *Fate of pollutants, *Volatile organics, *Chlorinated organic compounds, *Groundwater pollution, Biodegradation, Organic compounds, Trichloroethylene, Tetrachloroethylene, Chemical analysis, Bacteria.

The presence of the highly volatile chloroethene compounds - vinyl chloride, 1,1-dichloroethene, cis- and trans-1,2-dichloroethene - in raw ground-

water is probably a result of biodegradation of trichloroethylene and/or tetrachloroethylene, which are found widely spread in the environment. A simple laboratory method was developed for assaying biodegradation of highly volatile chlorinated organic compounds in water, soils and sediments, and bacteria culture media. All of the chlorinated methane, ethane, and ethene compounds studied appear to be susceptible to biodegradation in the environment. A rate-of-biodegradation technique, based on the assumption that the degradation slope observed was constant in the test conditions, assigned biodegradation half-life values for all the compounds tested under anaerobic conditions favoring daughter compound formation. The bacterial population profile of a given system, which varies seasonally, appears to determine the intermediate biodegraded chlorinated organic compound profile in the system. The resulting concentration of the lower chlorinated compounds may be dependent on the individual half-life of each product and the favored end-product of biodegradation in a given system. Using a technique for estimation of biodegradation half-life for the families of chlorinated compounds studied, an understanding could predict the chlorinated organic profile and transport in an environmental system after introduction of any single member of the family. Field data from actual below-ground accidental spills of these halogenated parent compounds in Florida and other states has confirmed these laboratory biodegradation findings. Tentative conclusions are presented for specific bacterial activity in the biodegradation of tetrachloroethylene under laboratory conditions. (See also W88-02533) (Lantz-PTT)
W88-02557

BASIC CONCEPTS FOR GROUND WATER TRANSPORT MODELING,
National Center for Ground Water Research, Norman, OK.
P. B. Bedient, R. C. Borden, and D. I. Lieb.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 512-531, 4 fig, 34 ref.

Descriptors: *Groundwater movement, *Path of pollutants, *Hydrologic models, *Model studies,Advection, Dispersion, Adsorption, Mathematical equations, Hydraulic conductivity.

Basic concepts in groundwater transport modeling include problems in both one and two dimensions with advection, dispersion, adsorption and decay. The 1-D solutions to the advective dispersion equation allow simple predictions of breakthrough with adsorption or decay. Analytical expressions allow reasonable estimates for travel time and spreading of contaminant fronts in 1-D. Two-dimensional models can be solved analytically for simple boundary conditions, but numerical models are generally required for actual waste problems. Various numerical techniques are available and are briefly reviewed in the chapter, but a more detailed description is included for the USGS method of characteristics model. The USGS model is a well-documented 2-D model capable of handling many typical field geometrics with waste ponds or pumping wells. Recent changes to the model allow consideration of adsorption. The final section reviews the serious problems of parameter estimation at field sites, including estimation of hydraulic conductivity, dispersivity, and adsorption coefficients. Extrapolation of results from laboratory column experiments to field sites has proven to be quite difficult, and therefore methods that can be directly applied to the field are being developed by researchers. Several of these methods, including the dual-tracer injection-production tests, for determining dispersion and adsorption coefficients at actual field sites are described in detail. (See also W88-02533) (Lantz-PTT)
W88-02558

APPLICATION OF A TWO-DIMENSIONAL MODEL OF HYDRODYNAMICS AND WATER QUALITY (CE-QUAL-W2) TO DEGRAY LAKE, ARKANSAS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 2H.
W88-02559

GROUNDWATER CONTAMINATION.
National Research Council, Washington, DC.
For primary bibliographic entry see Field 5E.
W88-02602

EXTENT OF GROUNDWATER CONTAMINATION IN THE UNITED STATES,
Academy of Natural Sciences of Philadelphia, PA.
V. I. Pye, and J. Kelley.
Groundwater Contamination, National Academy Press, Washington, DC. February 1984. p 23-33, 2 tab, 70 ref.

Descriptors: *Groundwater pollution, *Water pollution sources, *Path of pollutants, Animal wastes, Industrial wastes, Groundwater management, Water pollution control, Geohydrology, Groundwater movement, Groundwater recharge, Saline water intrusion, Domestic wastes, Agricultural runoff.

The summaries of groundwater pollution sources completed by the U. S. EPA and the Environmental Assessment Council (EAC) show that contamination problems from several sources have been reported from all parts of the United States and that the problems vary from one region to another, depending on climate, population density, intensity of industrial and agricultural activities, and the hydrogeology of the region. The important sources of contamination identified in the EAC state summaries differ somewhat in order of importance from those identified by the EPA summaries. From the combined results of the two surveys, it is clear that human and sometimes animal wastes are a high-priority source of contamination throughout the country. In the EAC survey, human and animal wastes are among the top three contaminants in every state surveyed except California. Human wastes are ranked as highest-priority contaminants in three of the regions surveyed by the EPA - Northeast, Northwest, and Southwest. They are of medium-high priority in the southeastern and southcentral regions. Industrial wastes are also common and high-priority contaminants in most regions of the country. In the Northeast, both surveys show industrial waste disposal as the biggest source of groundwater contamination. In the southeastern and northwestern states surveyed by EAC, industrial wastes are the second most prevalent contaminants of groundwater, which concurs with the EPA regional survey. In the northcentral states, where agricultural activities are important, industrial wastes are ranked third in reported frequency of contamination. In the southwestern and southcentral states, disposal of oil-field brines accounts for a high percentage of industry-related contamination. Beyond industrial wastes and human and animal wastes, the sources of contamination vary considerably from one region of the country to another depending on the intensive activities of a particular state and the geographic and geologic location of the state. (See also W88-02602) (Geiger-PTT)
W88-02603

MOVEMENT OF CONTAMINANTS IN GROUNDWATER: GROUNDWATER TRANSPORT - ADVECTION AND DISPERSION,
Wisconsin Univ.-Madison.
M. P. Anderson.
Groundwater Contamination, National Academy Press, Washington, DC. February 1984. p 37-45, 5 fig, 47 ref.

Descriptors: *Groundwater movement, *Groundwater recharge, *Groundwater pollution, *Path of pollutants, *Dispersion, *Mathematical models, Advection, Geologic fractures, Water quality control, Geohydrology, Mathematical studies.

The state of the art for quantifying dispersion in continous porous media is discussed in relation to the movement of contaminants in groundwater. Results from several studies suggest that dispersion is non-Fickian near the source of the contaminant and therefore the standard form of the advection-dispersion equation does not apply. A modified form of the equation could be derived for analyzing non-Fickian transport for small times. The standard approach in analyzing dispersion involves the use of an average linear velocity and a dispersion term. Although there has been considerable progress within the past 5 yr in understanding the nature of macroscopic dispersion in porous media, to date, a credible, practical, and reliable model for analyzing contaminant transport near the source has not been identified. However, theoretical studies by several researchers suggest that for large times or large travel distances the dispersion component of the advection-dispersion equation can be represented by an expression analogous to Fick's second law of diffusion, and therefore the classical advection-dispersion equation will accuretely simulate contaminant transport in porous media, provided that dispersivity can be quantified in a meaningful way. Models of dispersion in fractured rock support the following conclusions: diffusion of contaminants from fractures to the rock matrix can serve as a significnat retardation mechanism; and, dispersion in the fracture can significantly accelerate the arrival of contaminants at a discharge point when velocities in the fractures are relatively low. Velocity in fractures can be represented using the so-called cubic law, a form of Darcy's law. (See also W88-02602) (Geiger-PTT)
W88-02604

CONTAMINANTS IN GROUNDWATER: CHEMICAL PROCESSES,
Waterloo Univ. (Ontario).
J. A. Cherry, R. W. Gillham, and J. F. Barker.
Groundwater Contamination, National Academy Press, Washington, DC. February 1984. p 46-64, 3 fig, 73 ref.

Descriptors: *Path of pollutants, *Water chemistry, *Groundwater pollution, *Groundwater movement, *Water pollution sources, *Leaching, *Chemical reactions, Organic compounds, Metals, Inorganic compounds, Model studies, Adsorption, Oxidation, Sorption.

The movement of most toxic contaminants in groundwater is affected by chemical reactions that cause transfer of contaminant mass between the liquid and solid phases or conversion of dissolved species from one form to another. The chemical attenuation of inorganic contaminants occurs mainly by adsorption, precipitation, oxidation, or reduction. Organic contaminants can be adsorbed or degraded by microbiological processes, but at present little is known about their behavior, particularly under the anaerobic conditions that are common in contaminated groundwater. Field and laboratory studies have established that various toxic heavy metals, transition metals, metalloids, radionuclides, and other inorganic species can be mobile or immobile in the groundwater zone, depending on the hydrogeochemical conditions represented by the pH, the redox condition, the ionic strength, the mineralogy, the solid-phase surface area and the complexing capacity. Although the importance of chemical reactions in the attenuation of contaminants is widely recognized, the capabilities for attenuation predictions are not well developed. This is the case because the chemical processes within dynamic groundwater systems are complex: consequently, many of the geochemical parameters in predictive models are problematic. The prediction problem is complicated by the fact that the chemical processes are continually influenced by the redistribution of dissolved species caused by molecular diffusion and mechanical dispersion. The complexities of these mixing processes contribute to the difficulties in developing reliable methods for predicting the chemical behavior of contaminants in the groundwater zone. (See also W88-02602) (Author's abstract)
W88-02605

SHALLOW LAND BURIAL OF MUNICIPAL WASTES,
Illinois State Geological Survey Div., Champaign.
For primary bibliographic entry see Field 5E.
W88-02606

DEEP BURIAL OF TOXIC WASTES,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 5E.
W88-02607

GROUNDWATER CONTAMINATION AND AQUIFER RECLAMATION AT THE ROCKY MOUNTAIN ARSENAL, COLORADO,
Geological Survey, Reston, VA.
L. F. Konikow, and D. W. Thompson.
Groundwater Contamination, National Academy Press, Washington, DC. February 1984. p 93-103, 87 fig, 1 tab, 15 ref.

Descriptors: *Path of pollutants, *Water pollution control, *Rocky Mountain Arsenal, *Colorado, *Waste disposal, *Groundwater pollution, *Leaching, *Industrial wastes, Hazardous materials, Monitoring, Groundwater management, Waste management, Aquifer management, Aquifer testing, Organic compounds, Water pollution sources, Wastewater treatment.

Groundwater contamination at the Rocky Mountain Arsenal, Colorado, is related to the disposal of liquid industrial wastes and to industrial leaks and spills that have occurred during the 40-yr history of operation of the Arsenal. From 1943 to 1956 the liquid wastes were discharged into unlined ponds, which resulted in contamination of part of the underlying alluvial aquifer. Since 1956, disposal has been accomplished by discharge into an asphalt-lined reservoir, which significantly reduced the volume of contaminants entering the aquifer. In the mid-1970's toxic organic chemicals were detected outside of the Arsenal in the alluvial aquifer. The Colorado Department of Health issued three orders, which called for a halt to unauthorized discharges, cleanup, and groundwater monitoring. Subsequently, a management commitment was was made to mitigate the problem. A pilot groundwater containment and treatment system was constructed in 1978; it consists of a bentonite barrier and several withdrawal wells to intercept contaminated groundwater along a 1500-ft length of the northern Arsenal boundary, treating the water with an activated carbon process, and injecting the treated water on the downgradient side of the barrier through several recharge wells. Because of the success of the pilot operation, it is being expanded at present to intercept most of the contaminated underflow crossing the entire north boundary. However, boundary interception alone cannot achieve aquifer restoration at the Arsenal. It is anticipated that the overall final program will also have to include elements of source containment and isolation, source elimination, process modification to reduce the volume of wastes generated, and development of alternative waste-disposal procedures that are nonpolluting. A variety of alternatives have been proposed and are currently being evaluated to determine the most feasible for implementation. The research, planning, and design studies that are necessary to achieve the reclamation goal at the Arsenal illustrate that an effective aquifer restoration program is difficult to design and expensive to implement. (See also W88-02602) (Author's abstract)
W88-02608

GEOLOGIC PROBLEMS AT LOW-LEVEL RADIOACTIVE WASTE-DISPOSAL SITES,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 5E.
W88-02609

GROUNDWATER FLOW MODELING STUDY OF THE LOVE CANAL AREA, NEW YORK,
GeoTrans, Inc., Reston, VA.
For primary bibliographic entry see Field 2F.
W88-02610

NONPOINT CONTAMINATION OF GROUNDWATER ON LONG ISLAND, NEW YORK,
Environmental Protection Agency, Washington, DC.
G. E. Kimmel.
Groundwater Contamination, National Academy Press, Washington, DC. February 1984. p 120-126, 2 fig, 26 ref.

Descriptors: *Groundwater pollution, *Water pollution sources, *Nonpoint pollution sources, *Path of pollutants, *Long Island, *New York, *Urbanization, Industrial wastes, Pesticides, Nitrates, Metals, Saline water intrusion, Organic compounds, Groundwater recharge, Geohydrology, Land use, Wastewater treatment.

The regional contamination of the groundwater supply of Long Island, New York resulting from the use of the land by all forms of man's activity is described. Nonpoint contamination is nearly island-wide because urbanization and agriculture have both contributed to the problem. The geohydrology of the island was studied as early as 1906. The unconsolidated sediments consist of four aquifers and two confining beds. Encroachment of saline water is documented in the first half of this century due to overpumping, especially in Kings County. Nitrate levels in groundwater have increased because of the widespread use of invidivual waste-disposal systems (cesspools and ceptic tanks) and the use of manure fertilizer on farmland. Heavy metals have not been found in appreciable amounts except in areas of point source contamination. Synthetic organic chemicals, mostly cleaning fluids and solvents, have been deposited directly into individual disposal systems where they infiltrate into the groundwater. Methylene blue active substances present in synthetic detergents are added largely through the discharge of individual waste-disposal systems but also occur from leaks in sewers and landfills. By 1980, pesticides had been identified in at least 1200 farm and residential wells in the north and south forks. Treatment of water supplies may become necessary in the future. Where treatment costs may be too costly, water may have to transported from one section of the island to another. (See also W88-02602) (Geiger-PTT)
W88-02611

HYDROGEOCHEMICAL STUDIES AT A LANDFILL IN DELAWARE,
Geological Survey, Reston, VA.
M. J. Baedecker, and M. A. Apgar.
Groundwater Contamination, National Academy Press, Washington, DC. February 1984. p 127-138, 8 fig, 3 tab, 15 ref. Geological Survey and DOE Agreement No. EPA-81-D-X0523.

Descriptors: *Landfills, *Leachates, *Groundwater pollution, *Relief wells, *Path of pollutants, Aquifers, Water pollution sources, Industrial wastes, Geochemistry, Aquifer testing, Leaching, Groundwater movement, Organic compounds, Metals, Monitoring.

Plumes of leachate have migrated downgradient from the Army Creek landfill in Delaware, a site used for disposal of industrial and municipal refuse during the 1960's. A series of contaminant-recovery wells was installed in the early 1970's between the landfill and downgradient water-supply wells to intercept and remove contaminated water. Beneath the landfill and immediately downgradient of the landfill large amounts of iron and manganese are dissolved, organic matter is oxidized and reduced, oxygen is consumed, ammonia is adsorbed, and nitrate is reduced. Farther downgradient some of the reactions are altered: iron and manganese precipitate, less organic matter is oxidized and reduced and more ammonia is removed by ion exchange. Farther downgradient the water chemistry is controlled largely by mixing. Measurements of chemical constituents in water near the landfill show that most constituents have decreased in concentration over an 8-yr period (1973-1981). As leachate moves downgradient, the attenuation of contaminants is controlled by the following processes: operation of the recovery-well system that removes contaminated water and reverses the local flow, dilution of leachate with native groundwater, mixing of anaerobic leachate with oxygenated water that facilitates the decomposition of organic matter and precipitation of metals, and interaction of contaminants with aquifer materials. Although the recovery-well system has intercepted and removed most of the contaminated water and the quality of water from most downgradient monitor wells has improved, the leachate remains anaerobic, large amounts of gases are generated, and refractory organic compounds are present. Continued pumping of contaminant-recovery wells has lowered the head in the aquifer and wasted a large amount of uncontaminated groundwater. (See also W88-02602) (Author's abstract)
W88-02612

ASSESSMENT OF THE POTENTIAL FOR RADIONUCLIDE MIGRATION FROM A NUCLEAR EXPLOSION CAVITY,
Los Alamos National Lab., NM.
D. C. Hoffman, and W. R. Daniels.
Groundwater Contamination, National Academy Press, Washington, DC. February 1984. p 139-146, 7 fig, 7 tab, 12 ref.

Descriptors: *Radioactive wastes, *Path of pollutants, *Groundwater pollution, *Water pollution sources, *Leaching, Leachates, Krypton radioisotopes, Ruthenium radioisotopes, Strontium radioisotopes, Monitoring, Radioactive tracers.

The source term for radionuclides in the region of the Cambric nuclear explosion has been determined. Drillback cores were obtained and analyzed, and water was pumped from several vertical zones and analyzed. Most of the radioactivity produced in the test was found to be retained in the fused debris with only low concentrations in the water that had been in contact with the debris for nearly 10 yr. Most of the radioactivity and the highest specific activities of all radionuclides were found to be in the region of the original explosion cavity. No activity was found 50 m below the cavity. Water from the region of highest radioactivity at the bottom of the cavity contained only tritium and Sr90 at levels higher than the recommended concentration guides for water in uncontrolled areas. During nearly 6 yr (over 1.5 billion gallons of water) of pumping from a satellite well located 91 m from the Cambric cavity, only tritium, which is present as HTO and chemically the same as the water, and Kr85, which seems to be dissolved in the water, have been positively identified in water removed from this well, although there is some evidence for the possible migration of minute amounts of Ru106. These results are consistent with laboratory studies, which indicate that, in general, radionuclide sorption is sufficiently high to preclude the migration of such nuclides from the original cavity to the satellite well in the near future. Pumping and radioassay of water from the satellite well will be continued to investigate the possible arrival of nonsorbing species. (See also W88-02602) (Author's abstract)
W88-02613

LEACHATE PRODUCTION, CONTROL AND TREATMENT,
Cleanaway Ltd., Rayleigh (England).
For primary bibliographic entry see Field 5E.
W88-02644

ACID RAIN SOURCEBOOK.
For primary bibliographic entry see Field 5G.
W88-02650

ACID RAIN: PROBLEM DEFINITION,
State Univ. of New York at Albany. Atmospheric Sciences Research Center.
For primary bibliographic entry see Field 5C.
W88-02651

COMBATTING ACID RAIN IN GERMAN POWERPLANTS,
Fichtner, Beratende Ingenieure fuer Energie- und Waermewirtschaft G.m.b.H. und Co. K.G., Stuttgart (Germany, F.R.)
For primary bibliographic entry see Field 5G.
W88-02657

CONTROL ALTERNATIVES AND THE ACID RAIN ISSUE,
Electric Power Research Inst., Palo Alto, CA.

Coal Combustion Systems Div.
For primary bibliographic entry see Field 5G.
W88-02659

BURNING LOWER-SULFUR COALS TO REDUCE SO2 EMISSIONS,
ICF, Inc., Washington, DC.
For primary bibliographic entry see Field 5G.
W88-02660

COAL CLEANING: THE FIRST STEP,
For primary bibliographic entry see Field 5G.
W88-02661

FLUIDIZED-BED BOILERS WITH SO2-EMISSIONS CONTROL,
Foster Wheeler Boiler Corp., Livingston, NJ.
R. L. Gamble.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p. 124-135, 11 fig.

Descriptors: *Fluidized beds, *Sulfur dioxides, *Emissions control, *Water pollution sources, Water pollution prevention, Air pollution, Coal, Fuel, Acid rain, Nitrogen oxides, Electric powerplants.

The treating of the acid rain problem by reducing the SO2 emissions from the combustion of fossil fuels has been the subject of considerable discussions, especially where the possibility of Federal legislation may tighten emissions-control requirements. While there are various techniques for reducing SO2 emissions, fluidized-bed combustion (FBC) within a limestone bed is the sole means of achieving a high-percentage reduction of SO2 emissions in situ with the fuel combustion. Since the discovery in 1970 that limestone in a fluidized bed causes the reduction of SO2 emissions, the technology has been commercialized (numerous industrial plants using FBC are now in operation) and is on the threshold of being applied in the utility industry. While most of the applications of FBC overseas have been geared tyo the use of low-grade fuels, many other countries are now requiring control of both SO2 and NOx emissions; The FBC technique is available to meet this requirement. Most of the applications in the United States have included SO2-emissions control since the first industrial-sized fluidized-bed steam generator went into service in 1976. Many industrial users are now incorporating cogeneraetion of electricity into the systems they are purchasing, which provides added economic benefits plus an environmental improvement. Retrofit of existing utility steam genertors shows the promise of providing still more economic and environmental benefits. (Lantz-PTT)
W88-02662

OPTIONS FOR REDUCING NOX, SO2 DURING COMBUSTION,
Babcock and Wilcox Co., Barberton, OH.
For primary bibliographic entry see Field 5G.
W88-02663

NONREGENERABLE WET FGD CONTROLS SO2 EMISSIONS,
For primary bibliographic entry see Field 5G.
W88-02664

CONTROLLING ACID RAIN WITH DRY SCRUBBING,
Niro Atomizer A/S, Soeborg (Denmark).
For primary bibliographic entry see Field 5G.
W88-02665

SELECTING OPTIMUM CONTROL TO REDUCE ACID RAIN,
Ebasco Services, Inc., New York.
For primary bibliographic entry see Field 5G.
W88-02666

USE REGENERABLE SCRUBBERS TO SLASH SO2 EMISSIONS,
United Engineers and Constructors, Inc., Philadelphia, PA.
For primary bibliographic entry see Field 5G.
W88-02667

GENERAL STATUS OF IGCC DEVELOPMENTS,
Electric Power Research Inst., Palo Alto, CA.
For primary bibliographic entry see Field 5G.
W88-02668

PRESSURIZED FLUIDIZED-BED COMBUSTION: A FUTURE OPTION,
American Electric Power Service Corp., Columbus, OH.
For primary bibliographic entry see Field 5G.
W88-02669

TECHNIQUES FOR REDUCING NOX FROM COAL-FIRED UNITS,
Combustion Engineering, Inc., Chattanooga, TN.
For primary bibliographic entry see Field 5G.
W88-02670

CONCENTRATION AND FLUX PROFILES OF PCBS, DDTS AND PAHS IN A DATED SEDIMENT CORE FROM THE LAGOON OF VENICE,
Venice Univ. (Italy). Facolta di Chimica Industriale.
B. Pavoni, A. Sfriso, and A. Marcomini.
Marine Chemistry MRCHBD, Vol. 21, No. 1, p 25-35, May 1987. 6 fig, 3 tab, 16 ref. (C.N.R.), Grant 83.02139.59.

Descriptors: *Path of pollutants, *Sediment analysis, *Sedimentation, *Chlorinated hydrocarbons, *Organic compounds, *Sediment cores, Lead isotopes, Venice, Lagoons, Sediments.

Concentrations of chlorinated hydrocarbons (p,p'-DDT, DDD, DDE, polychlorinated biphenyls) and polycyclic aromatic hydrocarbons were determined by GC, GC-MS and HPLC in the 15 sections of a 210Pb radiodated sediment core (50 cm length; 10 cm id) sampled in the lagoon of Venice. From the average sedimentation rate of each section, the fluxes of contaminants to the sediment surface were calculated and interpreted on the basis of the industrial evolution of the Venetian region. (Author's abstract)
W88-02675

HYDROCARBONS IN THE WATER COLUMN OF THE CARTEAU BAY (GULF OF FOS-SURMER, MEDITERRANEAN SEA),
Centre d'Oceanologie de Marseille (France).
R. Siron, G. Giusti, and F. Blanc.
Marine Chemistry MRCHBD, Vol. 21, No. 1, p 75-89, May 1987. 5 fig, 5 tab, 27 ref. Delegation Generale a la Recherche Scientifique et Technique Grant 84-217.

Descriptors: *Hydrocarbons, *Path of pollutants, *Carteau Bay, *Sediment-water interface, *Water pollution sources, Transport, Water pollution, Sediments, Distribution.

The distribution of hydrocarbons in the water column seems to be affected by inputs from both interfaces of accumulation: the surface microlayer and the water/sediment interface. Volatilization and accommodation appear to be the major factors controlling the fate of hydrocarbons, especially in the dissolved phase, whereas some classes of particles are confirmed as important supports for the transport of such pollutants. In this respect, the 20-200 micron planktonic fraction is less contaminated than the total suspended matter. This study gives evidence for intense bacterial degradation affecting the hydrocarbons in the whole water column. In spite of the chronic petroleum pollution, we have also observed the predominance of n-alkanes in the (n-C16; n-C18) and (n-C27, n-C29) boiling ranges, which could be used as biological markers in these highly polluted waters. (Author's abstract)
W88-02677

NIGHT-TIME N2O5/NO3 CHEMISTRY AND NITRATE IN DEW WATER,
Ford Motor Co., Dearborn, MI. Research Staff.
T. Y. Chang, G. Kuntasal, and W. R. Pierson.
Atmospheric Environment ATENBP, Vol. 21, No. 6, p 1345-1351, June 1987. 1 fig, 5 tab, 26 ref.

Descriptors: *Water chemistry, *Gas phase chemistry, *Atmospheric chemistry, *Nitric acid, *Acid rain, *Nitrates, *Dew, *Model studies, Chemical reactions, Deposition.

Night-time gas-phase chemistry and deposition of HNO3, NO3 and N2O5 to dew water have been evaluated by using a one-layer model and dew nitrate data obtained at a site on Allegheny Mountain in southwest Pennsylvania. The major source of dew nitrate is generally HNO3 vapor generated by photochemical reactions during daylight hours. However, if N2O5 is deposited to dew as efficiently as HNO3 vapor, the night-time deposition of N2O5 is shown to contribute significantly to dew nitrate. For a few events where the highest NO2 concentrations (13-16 ppb) were measured, it is shown that the deposition of N2O5 could have been the main source of nitrate in dew water. (Author's abstract)
W88-02682

VARIATION OF WET DEPOSITION CHEMISTRY IN SEQUOIA NATIONAL PARK, CALIFORNIA,
Sequoia and Kings Canyon National Parks, Three Rivers, CA.
T. J. Stohlgren, and D. J. Parsons.
Atmospheric Environment ATENBP, Vol. 21, No. 6, p 1369-1374, June 1987. 2 fig, 3 tab, 27 ref.

Descriptors: *Rain chemistry, *Water chemistry, *Rainfall, *Deposition, *Acid rain, *Sequoia National Park, Ions, Acidity, Rain, Nitrates, Sulfates.

Sequoia National Park has monitored wet deposition chemistry in conjunction with the National Atmospheric Deposition Program and National Trends Network (NADP/NTN), on a weekly basis since July, 1980. Annual deposition of H, NO3 and SO4 (0.045, 3.6, and 3.9 kg/ha/a, respectively) is relatively low compared to that measured in the eastern United States, or in the urban Los Angeles and San Francisco areas. Weekly ion concentrations are highly variable. Maximum concentrations of 324, 162, and 156 microequiv/L of H, NO3 and SO4 have been recorded for one low volume summer storm (1.4 mm). Summer concentrations of NO3 and SO4 averaged two and five times higher, respectively, than concentrations reported for remote areas in the world. There is considerable variability in the ionic concentration of low volume samples, and much less variability in moderate and high volume samples. (Author's abstract)
W88-02685

TREATING UNCERTAINTY IN MODELS OF THE ATMOSPHERIC CHEMISTRY OF NITROGEN COMPOUNDS,
UKAEA Atomic Energy Research Establishment, Harwell (England). Modelling and Assessments Group.
For primary bibliographic entry see Field 2K.
W88-02687

DEPOSITION OF RADIONUCLIDES FROM CHERNOBYL TO A FOREST IN BELGIUM,
Louvain Univ. (Belgium).
C. Ronneau, J. Cara, and D. Apers.
Atmospheric Environment ATENBP, Vol. 21, No. 6, p 1467-1468, June 1987. 2 tab, 2 ref.

Descriptors: *Path of pollutants, *Radionuclides, *Rainfall, *Chernobyl, *Fallout, *Belgium, Deposition, Radioactivity, Cesium isotopes.

In the course of a study performed on traditional pollutants, deposition of radionuclides from Chernobyl was observed at a forest in E Belgium. The main deposition flux occurred as a consequence of a 7.4 mm rainfall episode which took place on 4

May. The deposition behavior of radionuclides is very similar to the behavior of traditional pollutants with the noteworthy exception of radioactive cesium which seems to have been absorbed by tree foliage. Of all the radionuclides from Chernobyl detected, cesium occupies a conspicuous position because it is very likely absorbed by plant foliage in a rapid and efficient way. Controlling this air-rain-plant transfer is not an easy task because: (i) cesium is readily dispersed into the plant and, (ii) external contamination of plant material blurs the possible internal radioactivity. In any case, it seems reasonable to suggest that particular attention by drawn to this direct transfer which seems to be much more efficient than the transfer via soil and uptake by plant roots. (Alexander-PTT)
W88-02688

INFLUENCE OF INPUTS TO THE FIRTH OF FORTH ON THE CONCENTRATIONS OF TRACE METALS IN COASTAL WATERS,
Marine Lab., Aberdeen (Scotland).
P. W. Balls, and G. Topping.
Environmental Pollution ENVRAL, Vol. 45, No. 3, p 159-172, 1987. 12 fig, 1 tab, 13 ref.

Descriptors: *Water pollution sources, *Firth of Forth, *Coastal waters, *Trace metals, *Heavy metals, Distribution, Copper, Lead, Cadmium, Scotland, Sediments.

The distribution of copper, lead and cadmium in dissolved and particulate phases has been investigated in the Firth of Forth, Scotland, an embayment of the North Sea. The effect of riverine and anthropogenic trace metal inputs on concentrations in the Firth of Forth and adjacent North Sea is examined. For the dissolved phase the effect of such inputs is confined to the immediate area of discharge. Concentrations in the outer Firth are indistinguishable from those in coastal waters of the North Sea, ca. Cu, 0.2 microgram(ug)/cu dm (3.1nM); Pb, 0.025 ug/cu dm (0.12 nM) and Cd, 0.020 ug/cu dm (0.18 nM). There is evidence that particulates enhanced in trace metals, relative to bottom sediments, are leaving the Forth and entering the North Sea. Predictions of the total metal concentrations in the waters of the inner Firth, based on riverine, industrial and sewage associated inputs, show reasonable agreement with observed values. (Author's abstract)
W88-02690

MICROBIAL DESULFONATION OF SUBSTITUTED NAPHTHALENESULFONIC ACIDS AND BENZENESULFONIC ACIDS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Mikrobiologisches.
D. Zurrer, A. M. Cook, and T. Leisinger.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 7, p 1459-1463, July 1987. 3 fig, 2 tab, 22 ref.

Descriptors: *Wastewater treatment, *Fate of pollutants, *Biodegradation, *Naphthalenesulfonic acids, Desulfonation, Bacteria, Cultures, Wastewater, Organic compounds.

Sulfur-limited batch enrichment cultures containing one of nine multisubstituted naphthalenesulfonates and an inoculum from sewage yielded several taxa of bacteria which could quantitatively utilize 19 sulfonated aromatic compounds as the sole sulfur source for growth. Growth yields were about 4 kg of protein per mol of sulfur. Specific degradation rates were about 4 to 14 microkat/kg of protein. A Pseudomonas sp., an Arthrobacter sp., and an unidentified bacterium were examined. Each desulfonated at least 16 aromatic compounds, none of which served as a carbon source. Pseudomonas sp. strain S-313 converted 1-naphthalenesulfonic acid, 2-naphthalenesulfonic acid, 5-amino-1-naphthalenesulfonic acid, benzenesulfonic acid, and 3-amino-benzenesulfonic acid to 1-naphthol, 2-naphthol, 5-amino-1-naphthol, phenol, and 3-aminophenol, respectively. Experiments with 18O2 showed that the hydroxyl group was derived from molecular oxygen. (Author's abstract)
W88-02705

CHANGES IN ESCHERICHIA COLI CELLS STARVED IN SEAWATER OR GROWN IN SEAWATER-WASTEWATER MIXTURES,
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
P. M. Munro, M. J. Gauthier, and F. M. Laumond.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 7, p 1476-1481, July 1987. 5 fig, 6 tab, 31 ref. WHO Grant Fra16(K).

Descriptors: *Bioindicators, *Escherichia coli, *Adaptation, *Seawater, *Wastewater, Metabolism, Mortality, Starvation, Enzymes, Salt tolerance.

Some metabolic modifications of Escherichia coli cells during starvation in seawater were studied in laboratory microcosms. The apparent die-off of this bacterium under such conditions, as observed by comparing the enumeration of CFU in conventional freshwater media and direct epifluorescence counts, was partially prevented when cells were previously grown in salted organic medium or on seawater-wastewater agar. Beta-Galactosidase activity of starved cells disappeared gradually with time, even though some other enzymatic activities, such as that of alkaline phosphatase, increased. Moreover, some modifications of sensitivity to antibiotics, heavy metals, and bacteriophages in seawater- and wastewater-grown cells suggested that the cells undergo structural changes under natural marine conditions. These results provide additional experimental data indicating the possible active adaptation of E. coli cells to seawater. (Author's abstract)
W88-02706

EFFECT OF ADAPTATION TO PHENOL ON BIODEGRADATION OF MONOSUBSTITUTED PHENOLS BY AQUATIC MICROBIAL COMMUNITIES,
Procter and Gamble Co., Cincinnati, OH. Ivorydale Technical Center.
For primary bibliographic entry see Field 5C.
W88-02707

TILTED-BED SIMULATION OF EROSION AND CHEMICAL RUNOFF FROM AGRICULTURAL FIELDS: I. RUNOFF OF SEDIMENT AND SEDIMENT-ASSOCIATED COPPER AND ZINC,
Agricultural Research Service, Tifton, GA. Southeast Watershed Research Center.
R. D. Wauchope.
Journal of Environmental Quality JEVQAA, Vol. 16, No. 3, p 206-212, July-September 1987. 1 fig, 3 tab, 35 ref.

Descriptors: *Sediments, *Copper, *Zinc, *Erosion, *Runoff, *Path of pollutants, *Model studies, *Soil erosion, *Water pollution sources, *Agriculture, Pesticides, Simulated rainfall, Rainfall, Salts, Metals, Flow rate.

Pesticide loss from agricultural fields by runoff was simulated using a rainfall simulator over 2.2-by 1.2-m fiberglass 'tilted bed' soil trays. Intense rainfall events were applied to eight trays containing a loam soil at 1.3 + or - 0.4% slope. To simulate soil-surface-applied pesticides that are lost in the sediment phase of runoff, the soil surfaces of six of the trays (two were used as controls) were sprayed with aqueous solutions of Cu and Zn salts to give 'application rates' of 1 kg elemental Cu and Zn/ha. The rainfall simulator applied 30 mm of rain to the trays in 5 min with a CV of 10%, and an average of 7.6 mm of runoff was obtained with a CV of 14%. The trays that received salt applications showed significantly lower erosion rates (629 + or - 160 kg/ha) than those that did not receive salts (1200 + or - 100 kg/ha), even though the total salt applied was only 11 kg/ha. All measurable Cu and Zn was found in the sediment phase of the runoff, and enrichment of the metals in the sediment was a function of runoff flow rate. The estimated adsorption constants (K sub d) for Cu and Zn in this soil were 186 and 20, respectively, but this difference did not effect runoff losses; the total loads of Cu and Zn from individual trays, after correction for background Cu and Zn, were essentially identical and highly correlated with soil loss. The total losses of the tracers ranged from 3 to 7% of the amounts applied, in good agreement with field studies of losses of pesticides strongly bound to soil. These results suggest that this system may provide an inexpensive alternative to field testing for pesticide mobility in runoff, and provide insights into the physical process by which pesticides are entrained into runoff. (See also W88-02716) (Author's abstract)
W88-02715

TILTED-BED SIMULATION OF EROSION AND CHEMICAL RUNOFF FROM AGRICULTURAL FIELDS: II. EFFECTS OF FORMULATION ON ATRAZINE RUNOFF,
Agricultural Research Service, Tifton, GA. Southeast Watershed Research Center.
R. D. Wauchope.
Journal of Environmental Quality JEVQAA, Vol. 16, No. 3, p 212-216, July-September 1987. 1 fig, 1 tab, 21 ref.

Descriptors: *Atrazine, *Erosion, *Runoff, *Path of pollutants, *Soil erosion, *Water pollution sources, *Model studies, *Agriculture, Pesticides, Simulated rainfall, Rainfall, Field tests.

The concentrations and loads of atrazine (6-chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine) in runoff water from 'tilted-bed' soil trays under intense simulated rainfall were similar to losses reported in field studies. Atrazine was applied at rates of 2.7 to 3.4 kg/ha as emulsion, wettable powder, dispersible liquid, and dispersible granule formulations, on a loam soil in eight 2.2-by 1.2-m trays tilted to 1.3% slope. In simulated storms in which 3 cm of rainfall fell in 5 min and generated 0.7 cm of runoff, total atrazine losses ranged from 4 to 8% for the emulsion and dispersible-liquid applications and 9 to 12% for the dispersible-granule and wettable-powder formulations. One-fifth of the total losses occurred in the first liter of the runoff. This initial 'flush' loss of atrazine in the water front resulted in concentrations up to 23 mg/L in the first runoff depending on the differing particle sizes of the spray deposits of the different atrazine formulations. The tilted-bed/rainfall simulator system appears to offer promise as an inexpensive and convenient supplement to field experiments for characterizing pesticide movement or yield in runoff and evaluating the potential of new chemicals for nonpoint source pollution. (See also W88-02715) (Author's abstract)
W88-02716

SIMULTANEOUS DETERMINATION OF NITRIFICATION AND NITRATE REDUCTION IN SEDIMENT-WATER COLUMNS BY NITRATE-15 DILUTION,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. D. DeLaune, and C. J. Smith.
Journal of Environmental Quality JEVQAA, Vol. 16, No. 3, p 227-230, July-September 1987. 2 fig, 2 tab, 22 ref. NSF Grant BSR-841006.

Descriptors: *Analytical methods, *Nitrification, *Nitrate reduction, *Sediments, *Isotope studies, *Fate of pollutants, *Lakes, *Limnology, *Runoff, Nitrates, Incubation, Tracers.

The magnitude of N loss from nitrification-denitrification reactions in sediment-water columns of a freshwater lake of Louisiana Gulf Coast drainage basin receiving elevated N loading from agricultural runoff was determining using 15NO3 dilution. Isotope dilution using added labeled NO3 allowed for the simultaneous determination of nitrification and NO3 reduction in the sediment-water column. The contribution of internal NH4 pools in bottom sediment to NO3 content in water column through diffusion and nitrification was measured. Nitrate reduction averaged 134 micromol/sq m/h over a 50-d incubation period in the sediment-water columns. Nitrification averaged 90 micromol/sq m/h, approximately 70% of the denitrification rate. Nitrification and ammonium assimilation were also determined in lake water using 15N-labeled NH4 as a tracer. The nitrification rate determined in the water (0.9-1.4 mmol N cu m/d) was less than the

rates measured in the sediment-water columns (1.4-3.3 mmol N cu m/d) using 15NO3 dilution. The results presented and isotope dilution technique used are applicable for use in understanding the fate of N in sediment-water systems of other aquatic environments. (Author's abstract)
W88-02718

ELEMENT LEACHING AND CAPILLARY RISE IN SANDY SOIL CORES: EXPERIMENTAL RESULTS,
Atomic Energy of Canada Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.
For primary bibliographic entry see Field 2G.
W88-02722

FLUORIDE DISTRIBUTION AND TRANSPORT ALONG RIVERS IN THE FRENCH ALPS,
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
A. Kudo, J.-P. Garrec, and R. Plebin.
Ecotoxicology and Environmental Safety EESADV, Vol. 13, No. 3, p 263-273, June 1987. 2 fig, 5 tab, 12 ref.

Descriptors: *Fluorides, *Path of pollutants, *Rivers, *French Alps, *Sediments, *Water analysis, Plants, Tissue analysis, Transport, Arc river.

Fluoride concentrations in water, sediments, and plants were determined at 26 locations along five rivers in the French Alps where aluminum factories have been discharging fluoride into the surrounding environment since the end of the last century. Despite a wide range of biological and constructional damages caused by fluoride contamination in the past, there was no alarming level of fluoride found in the water, sediments, or plants. Fluoride concentration in water ranged from 0.11 ppm (considered to be natural background level) to 0.62 ppm (moderate contamination). The highest fluoride concentration was 360 ppm in sediments and 207 ppm in plants. The increase of fluoride concentration along the rivers was gradual from upstream to downstream. This gradual increase suggested that the fluoride pathway was from factory to stack, to air, to the entire valley, and to the river. The amount of fluoride transported from the Maurienne valley by the Arc river was estimated to be 680 tons per year. Of this 97.8% tons (665 tons) was transported by the flowing water and the rest (2.2% or 15 tons) by sediments moving downstream. (Author's abstract)
W88-02726

ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES,
Texas A and M Univ., College Station. Dept. of Geology.
P. A. Domenico.
Journal of Hydrology JHYDA7, Vol. 91, No. 1/2, p 49-58, May 15, 1987. 3 fig, 10 ref.

Descriptors: *Path of pollutants, *Fate of pollutants, *Pollutant transport, *Groundwater movement, *Groundwater, *Mathematical models, *Model studies, *Data interpretation, *Groundwater pollution, Radioactive wastes, Biodegradation, Degradation half-life, Mathematical equations.

A mathematical model is developed for a finite source that incorporates one-dimensional groundwater velocity, longitudinal and transverse dispersion, and some form of decay for either radionuclides or biodegradable organics. The model is employed in a calibration procedure that permits the determination of up to seven parameters from a known spatial distribution of concentrations. The determined parameters include the velocity of the contaminant, source size and concentration, and up to three dispersivities for a three dimensional problem. For a biodegradable organic, a combined parameter incorporates the ratio of velocity to a degradation half-life and is readily determined form the field data. (Author's abstract)
W88-02766

COMPARING A THREE-DIMENSIONAL AND A DUPUIT-FORCHHEIMER SOLUTION FOR A CIRCULAR RECHARGE AREA IN A CONFINED AQUIFER,
Indiana Univ., Bloomington. School of Public and Environmental Affairs.
H. M. Haitjema.
Journal of Hydrology JHYDA7, Vol. 91, No. 1/2, p 83-101, May 15, 1987. 9 fig, 11 ref, 3 append.

Descriptors: *Path of pollutants, *Confined aquifers, *Groundwater movement, *Model studies, *Groundwater recharge, *Groundwater pollution, *Model studies, *Data interpretation, Fate of pollutants, Comparison studies, Dupuit-Forschheimer solution, Circular recharge, Mathematical models, Mathematical equations, Mathematical studies, Groundwater, Leaching.

An exact, closed-form analytic solution is presented for three-dimensional steady-state flow due to a source disc. The solution is used to model a circular recharge area at the upper boundary of a confined aquifer. Streamlines and contour plots of equipotentials are compared with those obtained from a Dupuit-Forschheimer solution. The latter solution is approximate in that resistance to vertical flow is ignored. As further illustration, a groundwater contamination problem is solved; that of a leaching circular pond in a uniform flow field. Some streamlines and the shape of the downstream plume are plotted for both the three-dimensional and the Dupuit-Forschheimer solution. It appears that when the recharge area is sufficiently large, the Dupuit-Forschheimer solution is quite adequate, particularly when tracing streamlines. The results, therefore, confirm the validity of the Dupuit-Forschheimer assumption when modeling regional flow, even under circumstances of areal recharge. However, when the size of the recharge area is in the order of the aquifer thickness, a truly three-dimensional solution is needed. (Author's abstract)
W88-02769

STOCHASTIC ANALYSIS OF CONTAMINANT TRANSPORT IN POROUS MEDIA: ANALYSIS OF A TWO-MEMBER RADIONUCLIDE CHAIN,
Sandia National Labs., Albuquerque, NM.
E. J. Bonano, L. R. Shipers, and A. L. Gutjahr.
Water Resources Research WRERAQ, Vol. 23, No. 6, p 1063-1078, June 1987. 5 fig, 22 ref, 2 append. USDE Contract DE-AC04-76DP00789.

Descriptors: *Pollutant transport, *Path of pollutants, *Fate of pollutants, *Radionuclides, *Radioactive wastes, *Stochastic hydrology, *Model studies, Mathematical models, Mathematical equations, Stochastic process, Porous media, Taylor expansion, Fourier analysis, Laplace equation, Systems analysis.

Previous stochastic analyses of contaminant transport in geologic media for a single species are extended to a chain of two species. The particular application is the quantification of uncertainties due to lack of characterization of the spatial variability of hydrologic parameters on transport of radionuclides from a high-level waste repository to the biosphere. Radionuclide chains can have a significant impact on demonstrating compliance (or violation) of standards regulating the release to the environment accessible to humans. Two approaches for determining the cross-variance terms in the mean concentration equations are presented. One uses a Taylor expansion to obtain the cross variance between the velocity and concentration fluctuations, while the other is based on a Fourier-Laplace double transform method. For the conditions of interest, the differences between these two approaches are expected to be small. The variances were calculated in a unique way by solving another associated partial differential equation. A parametric study was carried out to examine the sensitivity of the mean concentration of the two species and their corresponding variances and cross-covariance on the parameters associated with the structure of the stochastic velocity field. The dependent variables are most sensitive to the intensity and correlation length of the velocity fluctuations. The magnitude of the variances and cross-variance of the concentrations are proportional to the magnitude of the mean concentrations which depend on inlet concentration boundary conditions. (Author's abstract)
W88-02784

PESTICIDES IN RAINWATER IN THE NORTHEASTERN UNITED STATES,
Heidelberg Coll., Tiffin, OH. Water Quality Lab.
R. P. Richards, J. W. Kramer, D. B. Baker, and K. A. Krieger.
Nature NATUAS, Vol. 327, No. 1560, p 129-131, May 1987. 4 fig, 1 tab, 15 ref.

Descriptors: *Water pollution sources, *Rain, *Pesticides, *Path of pollutants, Fate of pollutants, Herbicides, Insecticides, Ohio, Indiana, Detection limits, Seasonal variation, Data collections.

The use of agricultural herbicides in the United States increased 280% between 1966 and 1981; insecticide use also increased, but only by a few percent. Since 1981, pesticide use has fluctuated with crop acreage, and shows no clear increasing or decreasing trend. Compared to their predecessors, currently used herbicides are not very toxic to animals, and both herbicides and insecticides are less persistent and show less tendency to bioaccumulate, but are more soluble in water, and therefore, more mobile in the environment. Previous studies of these compounds reported their movement to the edge of the field by surface transport in rainfall runoff, their presence in surface and groundwater, and their seasonal presence in drinking water supplies. Previously only one study reported any of these compounds in rainwater: atrazine was reported in Maryland in concentrations as high as 2.19 micrograms/liter. Data for herbicides and insecticides detected in rainfall in various parts of the USA are presented. Attention is called to the frequent seasonal presence of 11 compounds in rain, especially in Indiana and Ohio. (Wood-PTT)
W88-02790

ADSORPTION OF BUTACHLOR TO SOILS,
Monsanto Agricultural Research Station, Ibaraki (Japan).
T. Sato, S. Kohnosu, and J. F. Hartwig.
Journal of Agricultural and Food Chemistry JAFCAU, Vol. 35, No. 3, p 397-402, May-June 1987. 14 fig, 4 tab, 20 ref.

Descriptors: *Butachlor, *Adsorption, *Path of pollutants, *Soil contamination, *Herbicides, *Water pollution sources, Soil water, Rice, Fate of pollutants, Japan, Chromatography, Freundlich equation, Mathematical equations, Organic carbon, Temperature effects, Clausius-Clapeyron equation, Molecular structure, Kinetics.

The adsorption of butachlor (alpha-chloro-2,6-diethyl-N-(butoxymethyl)acetanilide) from water to rice paddy soils in Japan was studied with the use of high-pressure liquid chromatography in order to better understand its behavior. The adsorption to most soils was better described by the Freundlich isotherm than by the Langmuir isotherm. The adsorption to most soils increased with butachlor concentration, soil organic carbon, and temperature. The positive temperature dependence of adsorption implies that the adsorption is endothermic and the heat of adsorption is positive. The heat of adsorption, deltaH, calculated from the Clausius-Clapeyron equation was 5-7 kcal/mol, indicating that the adsorption is physical and reversible. The kinetics of adsorption and the effect of molecular weight of the herbicide on adsorption were also studied. The adsorption of alachlor (alpha-chloro-2,6-diethyl-N-(methoxymethyl)acetanilide) was measured to study the molecular weight effect. (Author's abstract)
W88-02792

IN VIVO AND IN VITRO ABSORPTION AND BINDING TO POWDERED STRATUM CORNEUM AS METHODS TO EVALUATE SKIN ABSORPTION OF ENVIRONMENTAL CHEM-

ICAL CONTAMINANTS FROM GROUND AND SURFACE WATER,
California Univ., San Francisco. School of Medicine.
R. C. Wester, M. Mobayen, and H. I. Maibach.
Journal of Toxicology and Environmental Health JTEHD6, Vol. 21, No. 3, p 367-374, 1987. 7 tab, 9 ref.

Descriptors: *Skin absorption, *Pollutants, *Testing procedures, *Path of pollutants, *Water pollution effects, Comparison studies, Method evaluation, Chemical binding, Chemical absorption, Fate of pollutants, Chemical properties, Hazardous materials, Toxins, Human physiology.

Methods of determining the binding and absorption of water contaminants to skin were compared, the linearity of response was examined, and the theory of skin as an environmental route for the entrance of water contaminants to the body was explored. Three chemicals were chosen for the study and obtained C-14 labeled from commercial sources: para-nitroaniline, benzene, and polychlorobiphenyls (PCBs). The study suggested that during a 30-minute bath or swim, chemical contaminants in water will be attracted to skin and bind to the stratum corneum, the outer layer of skin. More water-soluble chemicals stay in the water, while more the lipid-soluble ones, like PCBs, are attracted to the skin. Chemicals bound to the skin and not rinsed off were assumed to be absorbed into the body. Linearity appeared to depend on the chemical in question. For nitroaniline and benzene the results obtained by the in vivo and in vitro absorption methods and by binding to powdered stratum corneum seemed to agree with each other and with previous studies. The problems of in vitro absorption and failure of lipid-soluble chemicals to partition into the reservoir of the diffusion system were documented previously and it was concluded that the in vitro system can, therefore, give false negative data on skin absorption for this type of chemical. It was predicted that amounts approaching a milligram of chemical could be assimilated through skin and into the body as the result of a 30-minute exposure. (Wood-PTT)
W88-02795

MEMBRANE FILTER METHOD FOR THE ENUMERATION OF AQUATIC AMMONIFIERS,
Colorado State Univ., Fort Collins. Dept. of Microbiology and Environmental Health.
R. C. Warbington, K. L. Martin, D. A. Rice, D. G. Howell, and W. L. Boyd.
Water Research WATRAG, Vol. 21, No. 5, p 601-604, 1987. 3 tab, 8 ref.

Descriptors: *Ammonification, *Membrane filters, *Heterotrophic bacteria, *Path of pollutants, *Analytical methods, *Fate of pollutants, *Biodegradation, *Ammonia, Mineralization, Nitrogen compounds, Nitrogen cycle, Rivers, Streams, Lakes, Water pollution sources.

A standard procedure for the enumeration of heterotrophic bacteria, utilizing heterotrophic plate-count medium (m-HPC), has been modified to allow bacterial ammonifier populations also to be counted. Nessler's reagent was included as an outside indicator to ascertain what portion of the population is capable of ammonification. Typically the ammonifier population varied among aquatic habitats, ranging from 0.08 to 37.0% of the heterotrophic population in river water samples, 0.2 to 10.6% for irrigation water samples, and 1.4 to 3.0% for pond and lake water samples. (Author's abstract)
W88-02831

PRELIMINARY BOUNDS ON THE EXPECTED POSTCLOSURE PERFORMANCE OF THE YUCCA MOUNTAIN REPOSITORY SITE, SOUTHERN NEVADA,
Sandia National Labs., Albuquerque, NM.
For primary bibliographic entry see Field 5E.
W88-02835

HYDROLOGICAL PROPERTIES OF TOPOPAH SPRING TUFF: LABORATORY MEASUREMENTS,
Lawrence Livermore National Lab., CA.
For primary bibliographic entry see Field 5E.
W88-02836

ESTIMATING VOLATILE ORGANIC COMPOUND EMISSIONS FROM PUBLICLY OWNED TREATMENT WORKS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W88-02843

MOBILIZATION BEHAVIOR OF THALLIUM AND CADMIUM IN A RIVER SEDIMENT-(MOBILISATIONSVERHALTEN VON THALLIUM UND CADMIUM IN EINEM FLUSS SEDIMENT),
Indian Inst. of Tech., New Delhi. Dept. of Chemistry.
K. Gunther, W. Henze, and F. Umland.
Fresenius' Zeitscrift fuer Analytische Chemie ZACFAU, Vol. 327, No. 3/4, p 301-303, June 1987. 2 fig, 3 tab, 9 ref.

Descriptors: *Path of Pollutants, *Sediments, *Heavy metals, *Mobilization, *Thallium, *Cadmium, *Rivers, Water pollution, Complexes.

The mobility of thallium and cadmium was studied on a polluted river sediment. The metals are strongly bound to the sediment matrix. They are released in significant amounts beyond pH 2. The complexing agents NTA and HEDP have no influence on the mobilization behavior of both metals. The determinations were performed by flame AAS and ET-AAS. (Author's abstract)
W88-02855

RESEARCH IN ENVIRONMENTAL POLLUTION: III. DETERMINATION OF NITROFEN IN MAIN- AND RHINE-FISH(UNTERSUCHUNGEN ZUR UMWELTBELASTUNG: III. BESTIMMUNG VON NITROFEN IN MAIN- UND RHEINFISHEN),
Hessische Landwirtschaftliche Versuchsanstalt, Darmstadt (Germany, F.R.).
H. Steinwandter.
Fresenius' Zeitscrift fuer Analytische Chemie ZACFAU, Vol. 327, No. 3/4, p 363-364, June 1987. 2 fig, 5 ref.

Descriptors: *Path of pollutants, *Nitrofen, *Analytical methods, *Pesticides, *Chlorinated hydrocarbons, *Measuring instruments, *Rivers, *Fish, Chromatography, Tissue analysis.

In part I and part II of this series the identification of polychlorinated styrenes (PCS's) in Rhine-fish and polychlorinated nitrobenzenes (PCNB's) in Main-fish was reported. For identification the liquid-chromatographic elution profile determination of PCS's and PCNB's was a very helpful technique. Analyzing single polychlorinated biphenyl isomers (PCB's) for quantitative determination of PCB's in Main-fish, a peak was observed in the region of hexa- and heptachlorobiphenyls which could not be correlated with a single PCB component. For solving this problem, the successful technique of elution profile determination was also used as reported previously. By this procedure the unknown peak was identified as Nitrofen by GC-MS, GC-ECD and GC-NPD. For documentation of the above described separation procedure, chemical components of a Main-fish were collected in two fractions. The first 50 ml fraction, reduced to 2 ml, contained the non-polar substances. following 80 ml Nitrofen fraction. Nitrofen was also found in Rhine-fish. (Alexander-PTT)
W88-02856

DENITRIFICATION IN AQUIFER SOIL AND NEARSHORE MARINE SEDIMENTS INFLUENCED BY GROUNDWATER NITRATE,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 5C.
W88-02869

BACTERIAL COLONIZATION AND ENDOTOXIN CONTENT OF A NEW RENAL DIALYSIS WATER SYSTEM COMPOSED OF ACRYLONITRILE BUTADIENE STYRENE,
Harvard School of Public Health, Boston, MA.
G. C. du Moulin, E. C. Coleman, and J. Hedley-Whyte.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 6, p 1322-1326, June 1987. 3 fig, 1 tab, 13 ref.

Descriptors: *Pollutant identification, *Water treatment, *Construction materials, *Water reuse, *Water pollution sources, *Path of pollutants, *Plastic piping, *Bacteria, *Endotoxins, *Renal dialysis systems, Disinfection, Formaldehyde, Public health.

Endotoxin and bacterial levels were measured in tap water, in water purified by reverse osmosis, and in dialysate samples over a 4-month period in a new 10-bed renal dialysis unit. Water treated by reverse osmosis is conducted to the 10 stations through 111 m of piping composed of acrylonitrile butadiene styrene (ABS). All determinations were made prior to the opening of the unit and after the system was purged for 35 h with all bedside station taps open. Formaldehyde disinfection of the piping system was attempted with a recommended protocol after 11 weeks by feeding 2.5 liters of 37% formaldehyde (0.85%, vol/vol) into the delivery system. Prior to water purging, 24 ng of endotoxin per ml was detected. This level decreased to 2.0 ng of endotoxin after the purging. Levels of endotoxin remained below 1.0 ng of endotoxin per ml throughout the duration of the study. In contrast, the level of viable microorganisms recovered from the treated water was approximately 35,000 CFU/100 ml. Even after disinfection of the system, there was no significant decrease in culturable bacteria from the water even though endotoxin levels were lower. Species isolated from the renal dialysis system were predominately pseudomonads, whereas species isolated from the tap water were Bacillus and Flavobacterium species. ABS provides a surface suitable for long-term colonization and growth of bacteria. Currently recommended decontamination protocols are ineffective in removing potentially pathogenic bacteria from ABS pipes and thus constitute an increased risk to patients undergoing dialysis. (Author's abstract)
W88-02870

INCIDENCE OF VIBRIO CHOLERAE FROM ESTUARIES OF THE UNITED STATES WEST COAST,
Food and Drug Administration, Seattle, WA. Seafood Products Research Center.
C. A. Kaysner, C. Abeyta, M. M. Wekell, A. DePaola, and R. F. Stott.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 6, p 1344-1348, June 1987. 4 fig, 1 tab, 28 ref.

Descriptors: *Water pollution sources, *Path of pollutants, *Estuaries, *Vibrios, *Shellfish, *Sediments, Pollutant identification, Isolation, Natural waters, Food chain, Enterotoxins, Cytotoxicity.

The incidence of Vibrio cholerae in shellfish, sediment, and waters of California, Oregon, and Washington was determined during the summer of 1984. Samples from 24 distinct estuaries were analyzed qualitatively. V. cholerae non-O1 was found in 23 estuaries and in 44.6% of the 529 samples examined. V. cholerae O1 Inaba was isolated from water samples in Morro bay, Calif. Vibrio mimicus was found in 2.3% of the samples. Cholera enterotoxin was not found in cell-free filtrates of the 100 isolates tested in the Y-1 mouse adrenal cell assay, but heat-labile cytotoxic activity was observed with 3% of the isolates. (Author's abstract)
W88-02871

VIRULENT STRAINS OF VIBRIO VULNIFICUS ISOLATED FROM ESTUARIES OF THE UNITED STATES WEST COAST,

Food and Drug Administration, Seattle, WA. Seafood Products Research Center.
C. A. Kaysner, C. Abeyta, M. M. Wekell, A. DePaola, and R. F. Stott.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 6, p 1349-1351, June 1987. 2 tab, 25 ref.

Descriptors: *Water pollution effects, *Bioassay, *Pollutant identification, *Water pollution sources, *Path of pollutants, *Estuaries, *Vibrios, *Shellfish, *Sediments, Isolation, Natural waters, Food chain, Enterotoxins, Cytotoxicity.

Vibrio vulnificus was isolated from United States West Coast estuaries at a low frequency (5.9%) from 529 samples of water, shellfish, and sediment. Four strains tested with iron-treated mice had 50% lethal dose values ranging from 7.6 to 360 CFU, for a clinical isolate that caused the death of a septicemic patient. The presence of this pathogen may be a hazard to users of marine beaches and consumers of raw shellfish on the West Coast, especially to persons most susceptible to V. vulnificus septicemia. Species-specific antiflagellar serum and a gene probe for cytotoxin-hemolysin production were useful for screening these environmental isolates. (Author's abstract)
W88-02872

REDUCTION OF SELENATE TO SELENIDE BY SULFATE-RESPIRING BACTERIA: EXPERIMENTS WITH CELL SUSPENSIONS AND ESTUARINE SEDIMENTS,
Geological Survey, Menlo Park, CA.
J. P. Zehr, and R. S. Oremland.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 6, p 1365-1369, June 1987. 3 fig, 1 tab, 29 ref.

Descriptors: *Estuaries, *Selenate reduction, *Bacteria, *Sediments, *Path of pollutants, *Fate of pollutants, *Selenium, *Selenides, Sulfides, Sulfates, Trace levels, Ions.

Washed cell suspensions of Desulfovibrio desulfuricans subsp. aestuarii were capable of reducing nanomolar levels of selenate to selenide as well as sulfate to sulfide. Reduction of these species was inhibited by 1 mM selenate or tungstate. The addition of 1 mM sulfate decreased the reduction of selenate and enhanced the reduction of sulfate. Increasing concentrations kept in 1 mM selenate were incapable of reducing either selenate or sulfate when the selenate/sulfate ratio was $>$ or $=$ 0.02, indicating that irreversible inhibition occurs at high selenate concentrations. Anoxic estuarine sediments having an active flora of sulfate-respiring bacteria were capable of a small amount of selenate reduction when ambient sulfate concentrations were low ($<$ 4 mM). These results indicate that sulfate is an inhibitor of the reduction of trace quantities of selenate. Therefore, direct reduction of traces of selenate to selenide by sulfate-respiring bacteria in natural environments is constrained by the ambient concentration of sulfate ions. The significance of this observation with regard to the role sediments play in sequestering selenium is discussed. (Author's abstract)
W88-02873

MULTI-PHASE NON-STEADY STATE EQUILIBRIUM MODEL FOR EVALUATION OF ENVIRONMENTAL FATE OF ORGANIC CHEMICALS,
Mitsubishi-Kasei Inst. of Life Sciences, Tokyo (Japan).
K. Yoshida, T. Shigeoka, and F. Yamauchi.
Toxicological and Environmental Chemistry TXECBP, Vol. 15, No. 3, p 159-183, 1987. 3 fig, 6 tab, 7 ref.

Descriptors: *Fate of pollutants, *Model studies, *Organic compounds, Sediments, Natural waters, Distribution, Japan, Population exposure.

A simple mathematical fate model, Multi-Phase Non-Steady State Equilibrium Model (MNSEM) is proposed to evaluate distribution, persistence, and concentrations of chemicals in a model environment consisting of air, water, soil and sediment phases. The model is applied to evaluation of environmental fate and concentration of trichloroethylene and 1,4-dichlorobenzene under generic conditions representative of Japan. Evaluated chemical concentrations in air are within a factor of 3 of average values in Japanese atmosphere, and evaluated concentrations in water, sediment, or fish are greater than an order of magnitude below detection limits in real environments, so that evaluated concentrations are in reasonable agreement with environmental measurement data in Japan. Although MNSEM is not a model for site-specific evaluation of environmental fate, results suggested that this model is an adequate method to aid in evaluation of fate of chemicals under generic environment conditions. Evaluated concentration-profiles may be used to estimate average chemical exposure concentrations for humans and the environment. (Author's abstract)
W88-02881

LOGISTICS OF OIL SPILL DISPERSANT APPLICATION, VOLUME I: LOGISTICS - RELATED PROPERTIES OF OIL SPILL DISPERSANTS,
Transportation Systems Center, Cambridge, MA.
J. Bellantoni.
Available from the National Technical Information Service, Springfield, VA 22161, as ADA-123018, A05 in paper copy, A01 in microfiche. CG-D-28-82, I, November 1982. Final Report. 8 p, 2 fig, 20 tab, 28 ref, 2 append.

Descriptors: *Oil spills, *Cleanup operations, *Dispersants, Oil pollution, Marine environment, Marine resources, Surfactants, Environmental protection, Water pollution control.

The logistics of oil dispersant application by the U.S. Coast Guard is discussed. Although the use of chemicals for oil spill dispersal is not presently widespread in the U.S., their use would have implications for the U.S. Coast Guard's marine environmental protection program. Volume one covers the logistics-related properties of oil spill dispersants. Data are reviewed for 13 dispersants. Manufacturer's data and published test results are also examined and information summarized with regard to classification, handling and storage, application, availability, and cost. (See also W88-02888) (Halterman-PTT)
W88-02887

LOGISTICS OF OIL SPILL DISPERSANT APPLICATION, VOLUME II: APPLICATION TECHNIQUES, STOCKPILING, DISPERSANT SELECTION, STRATEGIES,
Transportation Systems Center, Cambridge, MA.
For primary bibliographic entry see Field 5G.
W88-02888

BIODEGRADABILITY TESTING OF INDUSTRIAL WASTES AND INTRACTABLE SUBSTANCES,
National Inst. for Water Research, Pretoria (South Africa).
R. J. Drews.
Available from the National Technical Information Service, Springfield, VA 22161, as PB83-106732, A03 in paper copy, A01 in microfiche. CSIR Technical Guide K 57, August 1981. 24 p, 11 fig, 14 ref, append.

Descriptors: *Wastewater treatment, *Fate of pollutants, *Biodegradation, *Industrial wastes, *Microbial degradation, Biological wastewater treatment, Degradation, Activated sludge, Activated sludge process, Waste disposal.

The phenomenal increase in the range of synthetic products presently available necessitates reliable methods to determine the biodegradability of organic products and industrial wastes that are disposed of in the environment. This guide gives a short summary of the different methods that have been used for biodegradability tests. Biodegradability may be defined as the conversion of chemical organic compounds which are potential wastes or water pollutants, to innocuous substances through the action of living organisms. Methods available for biodegradability testing include incubation tests and laboratory plant scale tests. Incubation tests may broadly be classified into BOD type tests in filled and closed bottles, closed vessel shake flask tests, open flask or river die-away tests, open vessel incubation methods or respirometric methods. Laboratory plant scale tests encompass acclimatized activated sludge methods and biological bed methods. The batch feed method, continuous feed method, and biofilter packed-column method of biodegradability testing are described. The batch feed and continuous feed methods may be more suited than the packed column method for an easily degradable waste because of possible continuous fouling of the recycle tubes in the latter method. However, for wastes more difficult to degrade, the packed column method is more appropriate. The continuous-feed method is probably the most costly of the methods described. (Geiger-PTT)
W88-02895

HYDRO-GEOCHEMICAL STUDIES OF URANIUM MILL-TAILING PILES AT RIVERTON, WYOMING AND MAYBELL, COLORADO,
California Univ., Berkeley. Lawrence Berkeley Lab.
T. N. Narasimhan, R. M. Galbraith, A. White, A. Smith, and H. Schmidt.
Available from the National Technical Information Service, Springfield, VA 22161, as DE82-020572, A06 in paper copy, A01 in microfiche. LBL-14486, Annual Report for Fiscal 1981, May 1982. 93 p, 17 fig, 7 tab, 6 ref, append. Contract No. DE-AC03-76SF00098.

Descriptors: *Mine wastes, *Radioactive wastes, *Water pollution sources, *Geochemistry, *Geophysics, *Geohydrology, Soil water, Fate of pollutants, Uranium radioisotopes, Radium radioisotopes, Mine drainage, Hydraulic gradient, Piezometers, Boreholes.

As part of the Uranium Mill Trailings Remedial Action (UMTRA) Program, exploratory drilling was carried out from June to September, 1981 at six locations on the Riverton, Wyoming and Maybell, Colorado inactive tailings piles. To gain a maximum of data on one site before winter, the rest of the data collection was done at the Riverton site. Twenty-one piezometers were installed and three tensiometer soil water sampler nests were set up. A precipitation collector for isotope analysis and a rain/snow gage were also installed. Results showed that the tailings at Riverton are in a state of moderate saturation. Fluid potentials are higher than the water table elevation at all sites, indicating a downward hydraulic gradient in the central portion of the pile. The movement of water within the tailings is predominantly vertical. The water within the piles is acidic and high in dissolved solids. Isotope studies show that both shallow groundwater and groundwater from a depth of about 122 meters have a common meteoric origin. Several hot patches exist with enhanced radioactivity. The disequilibrium found between U and Ra indicate that radioactive isotopes are probably being transported from the tailings to the bedrock. (Geiger-PTT)
W88-02897

SO2, NO AND NO2 OXIDATION MECHANISMS: ATMOSPHERIC CONSIDERATIONS.
Acid Precipitation Series, Volume 3, Butterworth Publishers, Boston. 1984. Volume edited by Jack G. Calvert. Series edited by John I. Teasley. 254 p.

Descriptors: *Fate of pollutants, *Acid rain, *Precipitation, *Oxidation, *Nitrogen oxides, Sulfur oxides, Clouds, Fog, Kinetics, Sulfuric acid, Nitric acid, Ozone, Aerosols, Hydrogen peroxide, Iron, Manganese, Catalysts, Chemical reactions.

This volume reviews information on the current knowledge of acid rain chemistry, particularly mechanisms of aqueous phase oxidation of sulfur and nitrogen oxides. Experimental aspects of sulfur(IV) oxidation are stressed. The kinetics and empirical rate laws for sulfite oxidation by reactants are reviewed and the relative importance of

the possible oxidants is compared for realistic tropospheric conditions. Mechanisms for metal-catalyzed oxidation of sulfur(IV) and other aqueous phase pathways for acid generation are evaluated. These data are then used for modeling chemical transformations in fog water. Chemical conversion processes for sulfur and nitrogen compounds are reviewed with special attention to characteristic times and mass transport phenomena. The final chapter discusses the properties of atmospheric aqueous aerosols, cloud and fog microphysics, and modeling of cloud chemistry in atmospheric water droplets. (See W88-02900 through W88-02903) (Cassar-PTT)
W88-02899

KINETIC STUDIES OF SULFITE OXIDATION IN AQUEOUS SOLUTION,
Aerospace Corp., Los Angeles, CA.
L. R. Martin.
IN: Acid Precipitation Series, Volume 3: SO2, NO and NO2 Oxidation Mechanisms: Atmospheric Considerations, Butterworth Publishers, Boston. 1984. Volume edited by Jack G. Calvert. Series edited by John I. Teasley. p 63-100, 34 fig, 2 tab, 71 ref.

Descriptors: *Fate of pollutants, *Acid rain, *Precipitation, *Oxidation, Sulfur dioxide, Kinetics, Chemical reactions, Thermodynamics, Aerosols, Sulfites, Ozone, Hydrogen peroxide, Nitrous acid, Organic compounds, Iron, Manganese, Metals, Catalysts, Sulfuric acid, Particulate matter.

Empirical rate expressions for the oxidation of sulfur dioxide species in aqueous solution are presented. These expressions are designed to help the atmospheric modeler in calculating the oxidation rate of sulfur dioxide contributed by aqueous aerosols. The oxidation by molecular oxygen in solution is studied in uncatalyzed form and with catalysis by iron(+3), manganese(++), iron-manganese synergism, other metals, solid materials such as ash, organics (ethanol, acetone, acetic acid, toluene). Fast oxidants (ozone, hydrogen peroxide, and nitrous acid) are also discussed. (See also W88-02899) (Cassar-PTT)
W88-02900

KINETICS AND MECHANISMS OF THE CATALYTIC OXIDATION OF DISSOLVED SULFUR DIOXIDE IN AQUEOUS SOLUTION: AN APPLICATION TO NIGHTTIME FOG WATER CHEMISTRY,
California Inst. of Tech., Pasadena. W.M. Keck Lab. of Environmental Engineering Science.
M. R. Hoffmann, and D. J. Jacob.
IN: Acid Precipitation Series, Volume 3: SO2, NO and NO2 Oxidation Mechanisms: Atmospheric Considerations, Butterworth Publishers, Boston. 1984. Volume edited by Jack G. Calvert. Series edited by John I. Teasley. p 101-172, 10 fig, 14 tab, 197 ref, append. Contract No. R808086-1.

Descriptors: *Fate of pollutants, *Acid rain, *Precipitation, *Oxidation, *Fog, Sulfur dioxide, Catalysts, Sulfates, Metals, Iron, Manganese, Copper, Synergism, Chemical reactions, Ozone, Hydrogen peroxide, Nitrogen oxides, Nitric acid, Nitrates, Nitrous acid, Clouds, Diurnal variation.

Model studies indicate that in heavily polluted atmospheric water droplets, such as those found in urban fogs, the metal-catalyzed sulfur(VI) oxidation is the main contributor to formation of sulfur(VI) in the liquid phase. Under conditions prevalent in Los Angeles, liquid-phase oxidation of S(IV) to S(VI) accounts for sulfate concentrations of about 0.0005 mol/liter 4 hours after fog formation. Ozone oxidation of S(IV) is insignificant because of slow oxidation rates at the low pH, poor ozone solubility, and depletion of ozone by NO oxidation and lack of resupply from photochemical reactions at night. Although S(IV) oxidation by hydrogen peroxide is very rapid, it is limited by the amount of hydrogen peroxide in the system. This oxidant is also not replenished during the night. Since ferric hydroxide precipitates at pH 4, changing its catalytic properties, iron speciation must be considered in modeling. If the NO level is higher than that of ozone, the ozone first oxides NO very quickly to form NO2, which slowly oxidizes to nitrate. Below pH 4, S(IV) oxidation by ozone in this system is insignificant. (See also W88-02899) (Cassar-PTT)
W88-02901

GAS-AQUEOUS REACTIONS OF SULFUR AND NITROGEN OXIDES IN LIQUID-WATER CLOUDS,
Brookhaven National Lab., Upton, NY. Dept. of Energy and Environment.
S. E. Schwartz.
IN: Acid Precipitation Series, Volume 3: SO2, NO and NO2 Oxidation Mechanisms: Atmospheric Considerations, Butterworth Publishers, Boston. 1984. Volume edited by Jack G. Calvert. Series edited by John I. Teasley. p 173-208, 13 fig, 3 tab, 75 ref. Contract No. DE-AC02-76CH00016.

Descriptors: *Fate of pollutants, *Acid rain, *Precipitation, *Oxidation, Sulfur dioxide, Nitrogen oxides, Clouds, Kinetics, Ozone, Hydrogen peroxide, Sulfuric acid, Sulfates, Nitric acid, Nitrates, Chemical reactions.

Liquid-water clouds provide both a strong thermochemical driving force for reaction of sulfur and nitrogen oxides to form the respective oxyacids and a medium in which this reaction may take place. The rate of such reactions in the aqueous phase may be evaluated from knowledge of the rate law and of the aqueous-phase concentrations of the reagents and other species (specifically including H+) that enter into the rate law. The reaction rate per unit physical volume may ne evaluated through the integration of the aqueous-phase rate taken over the liquid-water distribution characterizing the cloud. As a first approximation the reaction rate may be evaluated under the assumption of equilibrium distribution of the reagent gases between the gas phase and aqueous solution. This assumption holds for the majority of situations of interest. In-cloud reaction rates for oxidation of S(IV) by hydrogen peroxide and by ozone appear to be significant at representative partial pressure of the reagents and cloud liquid water content, although with ozone the rate decreases sharply with decreasing pH. In contrast, the direct reaction of nitrogen oxides to form nitric acid is negligibly slow for representative conditions. However, transition metal catalysis of these reactions and the reaction of nitrogen dioxide with other dissolved substances, such as sulfur dioxide, remain potentially important pathways for aqueous-phase acid formation. (See also W88-02899) (Cassar-PTT)
W88-02902

AQUEOUS AEROSOL AS A REACTANT IN THE ATMOSPHERE,
Texas Univ. at Austin. Dept. of Chemical Engineering.
J. R. Brock, and J. L. Durham.
IN: Acid Precipitation Series, Volume 3: SO2, NO and NO2 Oxidation Mechanisms: Atmospheric Considerations, Butterworth Publishers, Boston. 1984. Volume edited by Jack G. Calvert. Series edited by John I. Teasley. p 209-249, 14 fig, 5 tab, 35 ref. Contract No. CR808601.

Descriptors: *Fate of pollutants, *Acid rain, *Precipitation, *Aerosols, Oxidation, Mass transfer, Clouds, Fog, Model studies, Chemical reactions, Sulfur oxides, Nitrogen oxides, Hydrogen peroxide, Ozone.

This paper examines and reviews the various rate processes involved in heterogeneous conversions in aqueous solution aerosols. Topics include the nature of aqueous atmospheric aerosols with a table detailing the cloud types important in these reactions, chemical reactions in aqueous solutions (particularly those of importance in aqueous-phase oxidation of sulfur dioxide), mass transfer and chemical reactions (transfer of gaseous species to a droplet surface, adsorption and transfer through air-droplet interface, transfer in the volume of the drop, and reaction in the volume of the drop), and the status of model studies in this field. (See also W88-02899) (Cassar-PTT)
W88-02903

METEOROLOGICAL ASPECTS OF ACID RAIN.
Acid Precipitation Series, Volume 1, Butterworth Publishers, Boston, 1984. Volume edited by Chandrakant M. Bhumralkar. Series edited by John I. Teasley. 243 p.

Descriptors: *Fate of pollutants, *Acid rain, *Meterology, Precipitation, Wind, Air pollution, Air masses, Sulfur dioxide, Storms, Model studies.

The atmosphere is a critical intermediate between emission of acidifying substances and acid deposition. It serves as a transporter, dilutor, chemical reactor, and depositor. Examples show how available meterological information (surface wind, upper air wind, hourly precipitation and temperature distribution, etc.) can be used in acid rain research. Models are available for pollutant transport and surface water chemistry. (See W88-02905 through W88-02917) (Cassar-PTT)
W88-02904

ACID RAIN: AN OVERVIEW,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
E. Gorham.
IN: Acid Precipitation Series, Volume 1: Meteorological Aspects of Acid Rain, Butterworth Publishers, Boston. 1984. Volume edited by Chandrakant M. Bhumralkar. Series edited by John I. Teasley. p 1-18, 111 ref.

Descriptors: *Water pollution sources, *Acid rain, Fate of pollutants, Lakes, Acidic water, Research priorities, Air pollution.

Acid deposition consists of sulfuric, nitric, and sometimes hydrochloric acids in rain and snow. The major sources are anthropogenic, particularly combustion of coal and oil. Although some pollution sources can be clearly identified and traced, many situations are quite complex due to a mixture of acids and the presence of natural neutralizing agents. Opinion is divided on the question, is acid rain getting worse. Acid precipitation was first described in 1852 in the industrial region of Manchester, England. Isolated studies documented acid rain over the next century. Modern studies began in 1955 when acid rain was discovered far from urban areas. Lake and stream acidification, which adversely affect aquatic life, are the primary concern. Probable long-term effects include forest soil impoverishment, reduced yields of agricultural crops, and corrosion of metals and concrete structures. Research needs are great. A major difficulty is the complexity and long-term nature of the problem. In spite of a lack of difinitive data, evidence as a whole strongly suggests that acid deposition is a major environmental problem which needs a permanent solution on an international basis. Nevertheless, strong action to control emissions of sulfur and nitrogen oxides is urged, without waiting for final scientific confirmation of acid deposition effects. (See also W88-02904) (Cassar-PTT)
W88-02905

NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM,
Interagency Task Force on Acid Precipitation, Washington, DC.
J. C. Bernabo.
IN: Acid Precipitation Series, Volume 1: Meteorological Aspects of Acid Rain, Butterworth Publishers, Boston. 1984. Volume edited by Chandrakant M. Bhumralkar. Series edited by John I. Teasley. p 19-31, 2 fig, 3 tab.

Descriptors: *Water pollution effects, *Acid rain, *Research priorities, Interagency Task Force on Acid Precipitation, National Acid Precipitation Assessment Program, Precipitation, Interagency cooperation.

The Interagency Task Force on Acid Precipitation (ITFAP) was established to provide a National Acid Precipitation Assessment Program (NAPAP). Its purpose is to increase understanding of the causes and effects of acid precipitation. The

strategy of the NAPAP includes building on previous efforts to develop a federal acid rain program, using existing knowledge for assessments and recommendations wherever possible, conducting research to develop more knowledge necessary for decision making, establishing a long-term National Trends Network for monitoring, and evaluating all information and policy implications for publication. Some of the research presently focuses on the quantitative relationship between emissions of acid precursors and acid deposition, the role of atmospheric processes, interactions between acid rain and other pollutants, the extent of damaged or sensitive ecosystems and water resources, the contribution of local vs. distant sources of acid, the potential for damage to vegetation and soils, and cost-effective ways to manage acid deposition. (See also W88-02904) (Cassar-PTT)
W88-02906

ATMOSPHERE AS DELIVERY VEHICLE AND REACTION CHAMBER FOR ACID PRECIPITATION,
Environmental Protection Service, Dartmouth (Nova Scotia).
R. W. Shaw.
IN: Acid Precipitation Series, Volume 1: Meteorological Aspects of Acid Rain, Butterworth Publishers, Boston. 1984. Volume edited by Chandrakant M. Bhumralkar. Series edited by John I. Teasley. p 33-55, 11 fig, 21 ref.

Descriptors: *Fate of pollutants, *Acid rain, *Meteorology, Precipitation, Sulfuric acid, Nitric acid, Chemical reactions, Wind, Turbulence, Dilution, Oxidation, Air pollution.

The atmosphere has several roles in the fate of acid-producing emissions. (1) Transporter. Prevailing winds carry pollutants in an easterly direction, picking up sulfate as they pass over industrialized and populated centers. The concentration of pollutant is inversely proportional to wind speed at the point of emission. (2) Dilutor. Turbulence occurs in both horizontal and vertical directions. Clear skies within anticyclones particularly favor photooxidation and accumulation of sulfate. (3) Chemical reactor. The most important reactions are oxidation of sulfur dioxide and nitrogen oxides to form sulfuric and nitric acids. These are nonlinear reactions, and reduction in sulfur content produces less than a proportional reduction in sulfuric acid. Although acid production would be expected to decrease in winter because of its dependence on photooxidation, it is 10 times higher than predicted for the solar energy available. This is explained by the presence of a long-lived oxidant, possibly hydrogen peroxide or ozone catalyzed by manganese. (4) Depositor. Dry deposition occurs in the absence of precipitation and is caused by diffusion to and adsorption on the surface. The difficulty of collecting dry deposition to simulate natural surfaces leaves many unanswered questions in this area. Wet deposition is important and highly variable and intermittent. The solubility of sulfur dioxide is nil in snow and decreases in rain with the pH of the droplet. (See also W88-02904) (Cassar-PTT)
W88-02907

ANALYSIS OF WIND AND PRECIPITATION DATA FOR ASSESSMENTS OF TRANSBOUNDARY TRANSPORT AND ACID DEPOSITION BETWEEN CANADA AND THE UNITED STATES,
Illinois Univ. at Urbana-Champaign.
B. L. Niemann.
IN: Acid Precipitation Series, Volume 1: Meteorological Aspects of Acid Rain, Butterworth Publishers, Boston. 1984. Volume edited by Chandrakant M. Bhumralkar. Series edited by John I. Teasley. p 57-92, 12 fig, 17 tab, 24 ref.

Descriptors: *Fate of pollutants, *Precipitation, *Acid rain, *Meteorology, Sulfuric acid, Nitric acid, Wind, Air pollution, Canada, Storms, Cyclonic precipitation, Clouds, Air pollution, Rainfall distribution.

Wind and precipitation data bases for North America were analyzed to understand better interstate and international transport of acidic, acidifying, and toxic substances. Sulfur dioxide and nitrogen oxides are transported preferentially toward the regions of most frequent significant precipitation days by prevailing winds and toward the east and northeast by major cyclonic storms. Clouds, which occur frequently over the highest SO2-emitting regions cause more sulfate to be precipitated nearer the emission point. Wind directions over the major SO2 sources are westerly or very close to westerly. The largest U.S.-to-Canada flows of pollutants occur at Spokane, Washington and Flint, Michigan. The largest Canada-to-U.S. flows occur at Buffalo, New York, and Maniwaki, Quebec. Spatial variability in hourly precipitation data on a state/province basis over a year was 18% in the east and 39% in the west. Variability was substantially greater for the individual seasons, highest in winter. The annual average percentage of time with precipitation, and median wet and dry period durations for the east were 4.1%, 3.3 hours and 138 hours, respectively; for the west, 2.9%, 2.2 hours, and 221 hours, respectively. A precipitation-wind rose for Flint, Michigan, showed that the most frequent directions for low, medium, and high precipitation rates were westerly in January and July, with the exception of the highest rate of precipitation in January, which was more frequently southerly. A comparison of Lagrangian and Eulerian precipitation statistics for these areas did not produce good agreement. (See also W88-02904) (Cassar-PTT)
W88-02908

MODELING POLLUTANT TRANSPORT FOR WET DEPOSITION CALCULATIONS,
North American Weather Consultants, Salt Lake City, UT.
D. J. McNaughton.
IN: Acid Precipitation Series, Volume 1: Meteorological Aspects of Acid Rain, Butterworth Publishers, Boston. 1984. Volume edited by Chandrakant M. Bhumralkar. Series edited by John I. Teasley. p 93-101, 5 fig, 9 ref.

Descriptors: *Fate of pollutants, *Acid rain, *Meteorology, Precipitation, Air pollution, Model studies, Regional Air Pollutant Transport Model, RAPT model, Sulfur dioxide, Sulfates, Rainfall, Storms.

Transport of pollutants through storm systems presents a complex problem of modeling that will require complex models for accurate simulations. Current regional air pollutant models perform reasonably, although there is no room for improvement, particularly in transport models. These models appear to provide a good link between transport and wet deposition. The question of why they do as well as they do is answered by the contribution of various components of the acid deposition problem. Calculations of current simple models such as the Regional Air Pollutant Transport Model (RAPT) show that wet deposition is a relatively smaller component than the dry deposition model component. Wet deposition model formulations can simulate important first precipitation encounters. Although advanced simulation models for pollutant transport are necessary to describe fully the effects of complex air flows in storms, more simplified models with slight improvements may still provide reasonable predictions within a broader tolerance level. (See also W88-02904) (Author's abstract)
W88-02909

MODELS OF THE EFFECTS ON ACID PRECIPITATION OF AIR MOTIONS IN DIFFERENT-SIZE STORMS,
Drexel Univ., Philadelphia, PA. Dept. of Physics and Atmospheric Science.
C. W. Kreitzberg.
IN: Acid Precipitation Series, Volume 1: Meteorological Aspects of Acid Rain, Butterworth Publishers, Boston. 1984. Volume edited by Chandrakant M. Bhumralkar. Series edited by John I. Teasley. p 103-109, 1 fig, 6 ref. Contract No. EY-76-S-02-2360.

Descriptors: *Fate of pollutants, *Acid rain, *Meteorology, *Storms, Wind, Precipitation, Trajectories, Scale effects, Model studies.

Relating sample water chemistry to sources of acid emissions was difficult to achieve using simplified models. Diverse regions can contribute acidity to any one storm sample. Likewise, one source can contribute acidity to many sampling points. The models ignored the variation in acidity of precipitation caused by cleansing en route. Also, pathological trajectories were avoided. The vertical wind shear effects were simplified to two or three streams. The limitation in computing trajectories may not be as serious as the sampling problem. Although trajectories and other information can be assembled on a case-study basis, it is not sufficient for long-term analysis. (See also W88-02904) (Cassar-PTT)
W88-02910

AIR POLLUTION TRAJECTORIES IN PRECIPITATING STORMS,
Brookhaven National Lab., Upton, NY.
P. Michael, and J. M. Hales.
IN: Acid Precipitation Series, Volume 1: Meteorological Aspects of Acid Rain, Butterworth Publishers, Boston. 1984. Volume edited by Chandrakant M. Bhumralkar. Series edited by John I. Teasley. p 111-118, 3 fig, 1 tab, 5 ref. Contract Nos. DEAC02-76CH00016 and 79-D-X-0533.

Descriptors: *Fate of pollutants, *Acid rain, *Meteorology, Precipitation, Wind, Trajectories, Storms, Rainfall, Clouds.

The sensitivity of source/receptor relationships to the assumptions made in the calculation of trajectories was illustrated by showing the results of pollutant transport calculations for two events in which precipitation associated with frontal systems was collected and analyzed. Trajectories for air parcels reaching Ithaca, New York, and Upton, New York, in May 1978 were calculated using three different averaging layers. These methods were as follows: default (layer from the first inversion during daylight and vertical standard deviation of the plume during nighttime), the level of the cloud base (1000-5000 m), and within the cloud layer (1500-3000 m). Very different trajectories were obtained for the two stations and the three methods. A second example using data from a storm in April 1979 used seven different transport layers. Results were grouped into two broad categories. Using lower level transport layers indicating that the air came to Upton, New York, from the northwest (central Canada, through Michigan, extreme western New York, and northeast Pennsylvania). Using transport layers above 1800 m results showed that the air came from the southwest (Ohio River Valley, through West Virginia and southern Pennsylvania). (See also W88-02904) (Cassar-PTT)
W88-02911

WINTERTIME PRECIPITATION CHEMISTRY IN NORTH GEORGIA,
Battelle Pacific Northwest Labs., Richland, WA.
M. T. Dana, A. A. N. Patrinos, E. G. Chapman, and J. M. Thorp.
IN: Acid Precipitation Series, Volume 1: Meteorological Aspects of Acid Rain, Butterworth Publishers, Boston. 1984. Volume edited by Chandrakant M. Bhumralkar. Series edited by John I. Teasley. p 119-144, 9 fig, 4 tab, 10 ref.

Descriptors: *Fate of pollutants, *Acid rain, *Meteorology, Precipitation, Storms, Powerplants, Water pollution sources, Air pollution, Winter, Georgia, Rainfall, Trajectories, Wind, Air masses, Sulfur dioxide, Sulfates.

The initial report of the study, Winter Study of Power Plant Effects (WISPE), concerned precipitation chemistry indirectly affected by powerplants in North Georgia. Although an entire winter season was covered by the field studies, results could be only tentatively related to other precipitation chemistry measurements and predictions of precipitation scavenging theory. Many of the parameter relationships such as concentrations, rainfall rates, and scavenging ratios, needed larger data bases because of variability from storm to storm. Sequential sample results illustrated the variability

of the concentration-rainfall rate relationship on a short time scale. The air mass trajectory models used in this study did not provide unambiguous trajectories for most of the events examined. (See also W88-02904) (Cassar-PTT)
W88-02912

TRACE METALS IN ATMOSPHERIC DEPOSITION AT AMERICAN SAMOA,
Department of Energy, New York. Environmental Measurements Lab.
S. J. Nagourney, and D. C. Bogen.
IN: Acid Precipitation Series, Volume 1: Meteorological Aspects of Acid Rain, Butterworth Publishers, Boston. 1984. Volume edited by Chandrakant M. Bhumralkar. Series edited by John I. Teasley. p 145-154, 8 fig, 6 tab, 6 ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Metals, Heavy metals, Aluminum, Iron, Lead, Manganese, American Samoa, Air pollution, Salt.

Several trace metals were collected in composite samples of wet, dry, and bulk deposition in American Samoa over a three-year period. Total wet-dry deposition (micrograms/sq m/month) were Mn, 12.0; Pb, 12.3; Al, 42.0; and Fe, 18.9. Calculations indicated that sea salt was not the major contributor of these elements. Deposition of the native basaltic soil was the source of Al and Fe. Mn and Pb were derived from local anthropogenic sources, from long-range transport, or both. (See also W88-02904) (Cassar-PTT)
W88-02913

MAJOR ION COMPOSITION OF ATMOSPHERIC DEPOSITION AND AIR PARTICULATES AT AMERICAN SAMOA,
Department of Energy, New York. Environmental Measurements Lab.
D. C. Bogen, S. J. Nagourney, and C. C. Torquato.
IN: Acid Precipitation Series, Volume 1: Meteorological Aspects of Acid Rain, Butterworth Publishers, Boston. 1984. Volume edited by Chandrakant M. Bhumralkar. Series edited by John I. Teasley. p 155-162, 1 fig, 6 tab, 14 ref.

Descriptors: *Water pollution sources, *Acid rain, *Meteorology, American Samoa, Sulfates, Chlorides, Nitrates, Salt, Air pollution.

Results from a typical analysis of total atmospheric deposition (January 2-31, 1979) given mg/sq m at American Samoa were as follows: chloride, 275; sulfate, 48.0; nitrate, 0.3; Na, 173; Mg, 24.8; Ca, 8.27; K, 8.55; and cations/anions ratio, 1.04. Calculations indicated that excess sulfate in the wet deposition samples may be from long-range atmospheric transport from continental sources or is derived from biogenic marine sources. (See also W88-02904) (Cassar-PTT)
W88-02914

CATALYSIS OF THE AUTOXIDATION OF AQUATED SULFUR DIOXIDE BY HOMOGENEOUS AND HETEROGENEOUS TRANSITION METAL COMPLEXES,
California Inst. of Tech., Pasadena. W.M. Keck Lab. of Environmental Engineering Science.
S. D. Boyce, M. R. Hoffman, P. A. Hong, and L. M. Moberly.
IN: Acid Precipitation Series, Volume 1: Meteorological Aspects of Acid Rain, Butterworth Publishers, Boston. 1984. Volume edited by Chandrakant M. Bhumralkar. Series edited by John I. Teasley. p 163-211, 20 fig, 8 tab, 107 ref. Contract No. R808086-01.

Descriptors: *Fate of pollutants, *Acid rain, *Meteorology, Catalysts, Sulfur dioxide, Chemical reactions, Hydrogen peroxide, Manganese, Iron, Oxidation, Cobalt, Vanadium, Chelation, Organic compounds.

Certain metal-catalyzed autoxidations of sulfite proceed via the formation of discrete inner-sphere complexes between the sulfite and the catalyst before electron transfer occurs. Results indicate that binding and subsequent activation of dioxygen plays a significant role in the catalytic cycle. Effective catalysts are complexes of Fe(++)/Fe(+++), Mn(++)/Mn(+++), Co(++)/Co(+++), and V(3+)/V(5+). Certain metal-catalyzed reactions of sulfite may be enhanced by a photoassisted pathway. This helps explain the relative differences between night- and daytime sulfur dioxide conversion rates. In liquid aerosol systems, the nature and role of dissolved organic molecules as competitive complexing agents must be considered. These substances accelerate the dissolution of ferric oxide and manganese dioxide, the likely sources of soluble iron and manganese in aerosol systems. Hydrogen peroxide is a major intermediate reduction product of the catalyzed oxidation of various sulfur compounds and oxidizable organic molecules. Preliminary research on hybrid organometallic catalysts has shown that attachment of homogeneous catalysts to solid surfaces produces a negligible loss of catalytic activity for the autoxidation of dissolved sulfur(4+). (See also W88-02904) (Cassar-PTT)
W88-02915

NORWEGIAN MODELS FOR SURFACE WATER CHEMISTRY: AN OVERVIEW,
Norsk Inst. for Vannforskning, Oslo.
R. F. Wright.
IN: Acid Precipitation Series, Volume 1: Meteorological Aspects of Acid Rain, Butterworth Publishers, Boston. 1984. Volume edited by Chandrakant M. Bhumralkar. Series edited by John I. Teasley. p 213-230, 12 fig, 2 tab, 19 ref.

Descriptors: *Fate of pollutants, *Acid rain, *Lakes, *Model studies, Water quality, Streams, Henriksen's model, Birkenes model, Norway, Acidic water, Alkalinity.

Two models for surface water acidification using Norwegian data are presented: Henriksen's empirical model for lake acidification and the Birkenes model for stream water chemistry. Henriksen's model is based on the hypothesis that acidification can be described as large-scale titration of a strong acid (acid rain) with bicarbonate (from biological activity and weathering). Nonmarine calcium and magnesium are the intrinsic parameter. A nomograph, plotting millequivalents/liter of Ca plus Mg against nonmarine sulfate concentration in the lake water or the pH of precipitation, predicts the pH of the lake. The Birkenes model was developed from extensive stream water analyses in the Birkenes watershed. Several relationships were noted. High acidity and high aluminum concentrations occurred during high discharge periods. Inverse relationships were noted between H+ and Ca. Sulfate levels were relatively higher in the first stormflow following dry periods in summer. The Birkenes model consists of several submodels: hydrologic and chemical (sulfates and cation). The Henriksen and Birkenes models complement each other. The former is useful for large-scale water quality variations, and the latter is useful for small-scale day-to-day variations. Since both models were developed to describe the present-day situation, they cannot be used for prediction without further evaluation. (See also W88-02904) (Cassar-PTT)
W88-02916

EFFECTS OF ACIDIC PRECIPITATION ON ATLANTIC SALMON RIVERS IN NEW ENGLAND,
Maine Univ. at Orono. Dept. of Zoology.
T. A. Haines, and J. J. Akielaszek.
Air Pollution and Acid Rain Report 18. FWS/OBS-80/4-.18, October 1984. Fish and Wildlife Service, Washington, DC. 108 p, 46 fig, 12 tab, 57 ref, 2 append.

Descriptors: *Fate of pollutants, *Water pollution sources, *Acid rain, *Streams, Water quality, Salmon, Atlantic salmon, Fish, Water pollution effects, Hydrogen ion concentration, Aluminum, Aquatic habitats, Rivers, Maine, Vermont, Acidic water.

Water quality was determined in 9 first- to third-order Atlantic salmon rivers in New England (8 in Maine with native salmon populations and 1 in Vermont undergoing restoration of the salmon population). Calcium was the major cation and sulfate was the major anion in most of the Maine streams. The Vermont stream had higher concentrations of most ions; biocarbonate was also present. pH, alkalinity, and levels of aluminum, calcium, magnesium, sodium, and potassium decreased during periods of high discharge in spring and fall. Sulfate and nitrate concentrations peaked at snowmelt before peak discharge. Alkalinity was diluted during high discharge. The pH and aluminum concentrations in second- and third-order streams were well within safe limits for salmon, even during periods of high discharge. First-order streams, however, reached levels of pH and aluminum concentration toxic to the early life stages of salmon. Water quality was very similar to that measured in 1969 with the exception of aluminum levels, which were much higher in the present study. At present, chemical conditions in the higher order streams are not critical for salmon survival. However, in first-order streams, which constitute 20-40% of the available salmon habitat, water quality may become critical with increased deposition of acid precipitation. (Cassar-PTT)
W88-02927

LARGE-SCALE OPERATIONS MANAGEMENT TEST OF USE OF THE WHITE AMUR FOR CONTROL OF PROBLEM AQUATIC PLANTS, REPORT 2: FIRST YEAR POSTSTOCKING RESULTS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 4A.
W88-02931

PROTECTING THE NATION'S GROUNDWATER FROM CONTAMINATION, VOLUME I.
Office of Technology Assessment, Washington, DC.
For primary bibliographic entry see Field 5G.
W88-02950

PROTECTING THE NATION'S GROUNDWATER FROM CONTAMINATION, VOLUME II.
Office of Technology Assessment, Washington, DC.
For primary bibliographic entry see Field 5G.
W88-02951

LOADS OF SUSPENDED SEDIMENT AND NUTRIENTS FROM LOCAL NONPOINT SOURCES TO THE TIDAL POTOMAC RIVER AND ESTUARY, MARYLAND AND VIRGINIA, 1979-81 WATER YEARS,
Geological Survey, Reston, VA. Water Resources Div.
R. E. Hickman.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Supply Paper 84-860, 1984. 82 p, 14 fig, 30 tab, 42 ref.

Descriptors: *Water quality, *Water pollution sources, *Potomac estuary, *District of Columbia, *Maryland, *Virginia, *Nonpoint sources, Suspended sediments, Nutrients, Biochemical oxygen demand, Phosphorous, Nitrogen, Dissolved silica, Stream discharge, Precipitation, Potomac River Basin, Anacostia River, Saint Clements Creek, Occoquan River, Estuaries.

Loads of suspended sediment, phosphorous, nitrogen, biochemical oxygen demand, and dissolved silica discharged to the tidal Potomac River and Estuary during the 1979-81 water years from three local nonpoint sources have been calculated. The loads in the rain falling upon the tidal water surface and from overflows of the combined sewer system of the District of Columbia were determined from available information. Loads of materials in the streamflow from local watersheds draining directly to the tidal Potomac River and Estuary downstream of Chain Bridge in Washington D.C., were calculated from samples of streamflow leaving five monitored watersheds. Loads discharged from all local tributary watersheds were

calculated by applying to the unsampled watersheds yields determined for five monitored watersheds. The resulting loads are 2.7 million megagrams of suspended sediment, 3,000 megagrams of phosphorous, 14,000 megagrams of nitrogen, 78,000 megagrams of ultimate biochemical oxygen demand, and 68,000 megagrams of dissolved silica. The total loads discharged from all local nonpoint sources (local tributary watersheds, rainfall, and combined sewer overflows) are 2.7 million megagrams of suspended sediment, 3,300 megagrams of phosphorous, 18,000 megagrams of nitrogen, 78,000 megagrams of ultimate biochemical oxygen demands, and 69,000 megagrams of dissolved silica. These loads comprised 17 to 38 percent of the loads discharged by major sources during this period. (USGS)
W88-02952

USE OF THE ROUTING PROCEDURE TO STUDY DYE AND GAS TRANSPORT IN THE WEST FORK TRINITY RIVER, TEXAS,
Geological Survey, Bay Saint Louis, MS. Water Resources Div.
H. E. Jobson, and R. E. Rathbun.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Supply Paper 2252, 1984. 21 p, 10 fig, 3 tab, 12 ref.

Descriptors: *Dye releases, *Mathematical models, *Tracers, *Stream gaging, *Routing, *Path of pollutants, *Dispersion, *Lagrangian model, *West Fork Trinity River, Mass transfer, Mixing, Riffles, Rivers, Water quality, Desorption, Texas, Pools, Routing procedure, Transport.

The transport and dispersion characteristics of 13.4-mile (21.6-km) reach of the West Fork Trinity River near Fort Worth, Texas, were determined for a steady flow of about 27 cu ft/s (0.76 cu m/s) using rhodamine-WT dye as a conservative tracer and ethylene and propane gases as nonconservative tracers. Longitudinal dispersion coefficients and gas coefficients were determined using standard techniques and a routing procedure based on a Lagrangian transport model. The routing method procedure provided better estimates of the dispersion coefficient than the method of moments. Dispersion coefficients ranged from about 8 sq ft/s (0.7 sq m/s) for a reach consisting of a deep pool to about 21 sq ft/s (2.0 sq m/s) for a reach containing riffles and small pools. Gas desorption coefficients were virtually the same for the routing procedure and the standard peak method of computation. Desorption coefficients and liquid-film coefficients determined from the routing procedures were much smaller for the pooled reaches than for the reaches containing riffles. (USGS)
W88-02953

STREAMFLOW AND SPECIFIC-CONDUCTANCE DATA FOR BEAR CREEK, AUGUST 13, 1985, THE OAK RIDGE RESERVATION, TENNESSEE,
Geological Survey, Knoxville, TN. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-02954

NITRATE IN THE COLUMBIA AQUIFER, CENTRAL DELMARVA PENINSULA, MARYLAND,
Geological Survey, Towson, MD. Water Resources Div.
L. J. Bachman.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4322, 1984. 51 p, 15 fig, 11 tab, 30 ref.

Descriptors: *Groundwater pollution, *Water pollution sources, *Nitrates, *Maryland, Unconsolidated aquifers, Water quality, Chemical composition, Land use, Soil types, Unconfined aquifers, Delmarva Peninsula, Columbia aquifer.

A study of nitrate in water from 604 wells tapping the Columbia aquifer on the Delmarva Peninsula in eastern Maryland describes the factors that affect nitrate variability. Samples were collected from 196 randomly selected wells and analyzed for nitrogen species. Many were also analyzed for major ions. In addition, results of 313 nitrate analyses were randomly selected from county health department files. About 95 analyses of water samples collected from 1945 to 1978 were also evaluated. The frequency distribution of the nitrate analyses is bimodal, with 25 percent of the sample ranging from 0 to about 0.42 milligrams per liter (mg/L) nitrate as nitrogen (N), and the median is about 0.1 mg/L; the rest ranges from 0.42 to 58 mg/L, and the median is about 5.9 mg/L. The overall median nitrate concentration is about 3.5 mg/L as N. Over half of the samples had nitrate concentrations of 3 mg/L as N or higher, indicating that the water in the aquifer has been affected by human activity. Nitrate-nitrogen concentrations exceeded the water-quality standard of 10 mg/L in 15 percent of the samples established by the U.S. Environmental Protection Agency. The major factors affecting nitrate concentration are the presence of a nitrogen source, hydrogeological conditions, and the soil drainage. Sites with poorly drained soils may have a lower nitrate concentration either because the soils block the entrance of nitrate into the aquifer or because the aquifer under a poorly drained soil is associated with a chemical environment that promotes denitrification. (USGS)
W88-02969

PROGRESS REPORT ON THE GEOCHEMISTRY OF THE SULFUR CYCLE IN NORTHERN GREAT PLAINS COAL MINES,
Geological Survey, Bismarck, ND. Water Resources Div.
R. L. Houghton, R. D. Koob, and G. H. Groenewold.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 85-4016. 70 p, 10 fig, 8 tab, 96 ref.

Descriptors: *Sulfur, *Sulfur cycle, *Sulfur bacteria, *Isotope studies, *Coal mining, *Lignite, *North Dakota, Geochemistry, Water chemistry, Coal mine wastes, Northern Great Plains.

Limited data on the distribution and sulfur-isotopic composition of sulfur species in groundwater and sedimentary rocks and soils associated with lignite strip mines in western and central North Dakota indicate microbes play an important role in sulfur oxidation and sulfate reaction. Oxidation of microcrystalline and framboidal iron-sulfide minerals occurs within hours in the presence of oxygen and is mediated by sulfur-oxidizing bacteria. However, macrocrystalline pyrite is essentially inert to oxygen and microbial activity for decades. Sulfur oxidation appears to be greatest in spoils and low-pH microenvironments. Groundwater sulfate is derived from the repeated dissolution, precipitation, and redissolution of sulfate salts by infiltrating water. Sulfate reduction is most active in sandstone aquifers underlying lignite downgradient from the mine sites. Microbial activity is limited by the availability of organic material capable of being metabolized. Dissolved organic material present is largely unusable. It is apparent that extraction procedures used to collect supporting isotopic data induced additional oxidation in the samples. Accordingly, these preliminary results are subject to reinterpretation once new data are available. (USGS)
W88-02975

HYDROGEOLOGY OF EASTERN MICHAUD FLATS, FORT HALL INDIAN RESERVATION, IDAHO,
Geological Survey, Idaho Falls, ID. Water Resources Div.
N. D. Jacobson.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4201, 1984. 31 p, 8 fig, 4 tab, 24 ref.

Descriptors: *Water pollution sources, *Groundwater pollution, *Idaho, Water quality, Contamination, Heavy metals, Wastewater management, Fort Hall Indian Reservation, Michaud Flats, Snake River Plain.

Groundwater in Michaud Flats, southeastern Idaho, is developed extensively for irrigation and industry. Extensive clay beds overlie the Bighole Basalt and Sunbeam Formation, which yield most of the water for irrigation and industrial wells; artesian aquifers in these rock units have heads below land surface and near those in the shallow water-table aquifer in the overlying Michaud Gravel. Transmissivities in artesian aquifers range from 19,6000 to 444,000 feet squared per day. High levels of arsenic were detected in groundwater in the Flats in 1972. During 1982, concentrations of arsenic twice exceeded the recommended drinking water limit of 50 micrograms per liter. Concentrations of other chemical constituents were generally within drinking water limits. Stable-isotope data suggest more than one source of aquifer recharge and indicate some mixing between waters from industrial ponds and local groundwater. Management alternatives are being implemented by two industries for control of groundwater contamination. These include reduction of effluent, installation of liners and leachate recovery systems in ponds, and removal and reclamation of precipitates in old slurry and evaporation ponds. Six sites will be monitored through 1985 to determine changes in groundwater chemistry and migration of contaminants. (USGS)
W88-02976

STIMULATED EFFECTS OF INCREASED RECHARGE ON THE GROUND-WATER FLOW SYSTEM OF YUCCA MOUNTAIN AND VICINITY, NEVADA-CALIFORNIA,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-02977

CONTRIBUTIONS OF SUSPENDED SEDIMENT FROM HIGHWAY CONSTRUCTION AND OTHER LAND USES TO THE OLENTANGY RIVER, COLUMBUS, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
D. R. Helsel.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water Resources Investigations Report 84-4336, 1984. 31 p, 3 fig, 15 tab, 21 ref.

Descriptors: *Road construction, *Suspended sediments, *Ohio, Sediment load, Sediment yield, Water pollution sources, Olentangy River, Erosion.

Highway construction within the Olentangy River flood plain in Columbus, Ohio, was projected to be a large source of suspended sediment to the river system. A monitoring program was begun by the U.S. Geological Survey in 1978 to quantify the impacts of the construction process. Sediment information was collected daily at six gaging stations located above, below, and within the construction area. Yields of suspended sediment ranged from 9,580 to 15,700 tons per square mile per year. Surrounding suburban terrain yielded 428 to 754 tons per square mile per year. However, the size of the construction project was small in comparison to the surrounding suburbs contributing sediment. No more than 4 percent of the yearly downstream suspended sediment loads were produced by the construction during the monitoring period. (USGS)
W88-02978

HYDROLOGY OF THE FERRON SANDSTONE AQUIFER AND EFFECTS OF PROPOSED SURFACE-COAL MINING IN CASTLE VALLEY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 4C.
W88-03000

USE OF THE PAIRED-BASIN TECHNIQUE IN FLOW-RELATED WILDLAND WATER-QUALITY STUDIES,
Forest Service, Fort Collins, CO. Watershed Systems Development Group.

S. L. Ponce, D. W. Shindler, and R. Averett.
Report WSDG-TP-0004, April 1982. 21 p, 11 fig, 3 tab, 13 ref.

Descriptors: *Water quality standards, *Streamflow, *Paired basin technique, River basins, Forest lands.

Forest managers are confronted with the problem of determining the effect of timber harvest on water quality. This paper describes statistical techniques, primarily analysis of covariance, that provide a way of comparing streamflow and selected water quality measurements in an unharvested basin with those in a harvest basin. Discussion of the paired-basin technique includes illustrations and an example from the Bull Run basin, Mt. Hood National Forest, Oregon. A discussion of data-base size, and a method for determining the number of samples that will yield regression estimates at a predetermined level of statistical reliability also is given. Example applications include cause-and-effect evaluation, trend analysis, and cumulative-impact analysis. (USGS)
W88-03006

HYDROGEOLOGIC AND WATER-QUALITY CHARACTERISTICS OF THE UPPER CARBONATE AQUIFER, SOUTHEAST MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03011

HYDROLOGY AND WATER QUALITY OF THE ELK CREEK BASIN, WEST-CENTRAL WISCONSIN--AN ASSESSMENT OF NONPOINT DISCHARGES,
Geological Survey, Madison, WI. Water Resources Div.
S. J. Field, and R. A. Lidwin.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4094, 1985. 38 p, 8 fig, 25 tab, 20 ref.

Descriptors: *Small watersheds, *Water quality, *Hydrology, *Wisconsin, Water temperature, Dissolved solids, Sediment yield, Water pollution sources, Elk Creek, Bruce Valley Creek, Nonpoint-source discharge, Suspended-sediment yield, Total nitrogen load, Total phosphorous load.

The Elk Creek basin in west-central Wisconsin was studied during the 1980 water year to define the water quality in relation to streamflow. Agricultural nonpoint-source discharges were suspected of contributing significantly to degraded water quality. Streamflow for the 1980 water year was about 28 percent more than average and precipitation was about 36 percent greater than average. Streamflow at Elk Creek during the study ranged from 43 to 1,020 CFS; Bruce Valley Creek discharges ranged from 2.8 to 306 CFS. The low-flow discharges are significantly greater than the 2-year, 7-day low flow whereas the peak discharges were between a 2-year and a 5-year flood-recurrence interval. The suspended sediment yield for Bruce Valley Creek was 215 ton/sq mi, compared with 184 ton/sq mi for Elk Creek, during the 1980 water year. Double mass-accumulation curves, however, indicated that loading rates were similar for both stations. Phosphorous yields for Bruce Valley Creek during the 1980 water year were 1,600 lb/sq mi, compared with 1,350 lb/sq mi at Elk Creek. Double mass-accumulation curves indicated highest loading rates for these constituents at Bruce Valley Creek. Phosphorous concentrations at Bruce Valley and Elk Creeks exceeded levels recommended by the U.S. Environmental Protection Agency for prevention of nuisance biological growths. (USGS)
W88-03016

SENSITIVITY OF STREAM BASINS IN SHENANDOAH NATIONAL PARK TO ACID DEPOSITION,
Geological Survey, Richmond, VA. Water Resources Div.
For primary bibliographic entry see Field 5C.
W88-03017

SUMMARY OF NORTHERN ATLANTIC COASTAL PLAIN HYDROLOGY AND ITS RELATION TO DISPOSAL OF NUCLEAR WASTE IN BURIED CRYSTALLINE ROCK,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 5E.
W88-03020

WATER-QUALITY VARIATIONS IN ANTELOPE CREEK AND DEAD MAN'S RUN, LINCOLN, NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
R. A. Pettijohn, and R. A. Engberg.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4153, 1985. 36 p, 12 fig, 1 tab, 16 ref.

Descriptors: *Water quality, *Water pollution sources, *Nebraska, Chemical properties, Streams, Specific conductance, Water chemistry.

Eleven sets of samples from five sites on Antelope Creek and Dead Man's Run in Lincoln, Nebraska, were collected from December 1982 through June 1983 to study water-quality variations. Specific-conductance values generally were similar for Antelope Creek at 52nd Street and 27th Street, but during a low-flow survey of December 1 they increased from 974 to 8,700 microsiemens per centimeter at 25 C from 27th Street to Court Street. Seepage of saline water from underlying bedrock to the stream occurs in this reach. Specific-conductance values were less variable for Dead Man's Run, increasing an average of only 47 percent from 66th Street to U.S. Highway 6. Specific-conductance values were less at high flows in Antelope Creek, except in samples collected on January 6, 1983, which contained runoff from salted streets. Sodium and chloride concentrations in these samples were from 5 to 10 times greater than those measured in any other samples. Stray-current corrosion occurs when current flows between dissimilar metals. Zinc-coated wire of channel-stabilization structures (gabions) may be an anode and material within the stream banks may be a cathode. Dissolution of the zinc coating by this type of corrosion may be a cause for gabion deterioration in both streams. (USGS)
W88-03021

PRECISION AND BIAS OF SELECTED ANALYTES REPORTED BY THE NATIONAL ATMOSPHERIC DEPOSITION PROGRAM AND NATIONAL TRENDS NETWORK--1983 AND JANUARY 1980 THROUGH SEPTEMBER 1984,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 5A.
W88-03023

QUALITY OF GROUND WATER IN SOUTHEASTERN-SOUTH CENTRAL WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03027

TEMPORAL CHANGES IN CHLORIDE, SULFATE, AND SODIUM CONCENTRATIONS IN FOUR EASTERN PENNSYLVANIA STREAMS,
Geological Survey, Harrisburg, PA. Water Resources Div.
J. L. Barker.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4074, 1986. 22 p, 15 fig, 8 tab, 9 ref.

Descriptors: *Water quality, *Water pollution, *Statistical analysis, *Time series analysis, *Pennsylvania, *Susquehanna River, Regression analysis, Dissolved chloride, Dissolved sulfate, Dissolved sodium, Trends, Juniata River, Conestoga River, Schuylkill River.

Trend analyses of 20 years or more of chemical quality and streamflow data for four streams in eastern Pennsylvania indicate that sulfate has decreased significantly in three of the four basins studied, while sodium and chloride have generally increased. The majority of chemical quality changes occurred in the late 1950's and early 1960's coincident with significant cultural changes. It is believed that these chemical quality changes are presently of little or no environmental consequence, as the concentrations are well within the range of those found in natural waters. Decreases in sulfate follow a regional trend concurrent with the conversion of home and industrial heating units from high to low sulfur coal, gas, and oil. The most significant decreases were observed in those basins severely affected by mine-drainage where pumpage has decreased significantly in the past 25 years, thereby further reducing the sulfur content of the streams. The observed increases in chloride and sodium are attributed to population increases and shifts from rural to suburban communities with concurrent increase in the percentage of the population using municipal waste treatment facilities and the increased use of salt on roadways. The concentrations of dissolved chloride, which are from two to three times higher in recent years, reach a peak in January, coincident with the application of salt to melt ice on the roadways. (USGS)
W88-03030

HYDROGEOLOGIC CONDITIONS AND SALINE-WATER INTRUSION, CAPE CORAL, FLORIDA, 1978-81,
Geological Survey, Fort Meyers, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03032

APPARENT BRINE CONTAMINATION OF FRESHWATER AQUIFERS AND STREAMS IN PETROLEUM PRODUCING AREAS IN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
S. J. Kalkhoff.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4117, 1986. 106 p, 30 fig, 23 tab, 20 ref.

Descriptors: *Groundwater pollution, *Stream pollution, *Brine disposal, *Oil fields, *Mississippi, Water quality, Chlorides, Bromides, Strontium, Sodium, Water pollution sources, Oilfield brines.

A ground- and surface-water quality study was conducted in 1981 and 1982 to identify brine-contaminated streams and shallow aquifers in six major oil- and gas-producing areas in southern Mississippi. Brine contamination w present in shallow aquifers (less than 300 feet) and streams in parts of all study areas. Data indicate that there are a few instances of deeper groundwater contamination. Contamination was prevalent in the Mississippi River valley alluvial aquifer and in outcrop areas of the Miocene and Citronelle formations. Waters affected by oil-field brines have greater concentrations of strontium and bromide, ions normally found in relatively high concentrations in brine. Affected waters generally had lower pH values, and sodium to chloride ratios less than 0.60. As a result of the study, additional studies are suggested for five areas of Mississippi to determine the extent and movement of contaminants in order to plan for present and future water supplies. (USGS)
W88-03035

WATER QUALITY OF STREAMS IN SANTA CLARA VALLEY, SANTA CLARA COUNTY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
M. A. Sylvester.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigation Report 86-4196, 1986. 80 p, 23 fig, 8 tab, 23 ref.

Descriptors: *Streams, *Water quality, *Streamflow, *California, Rainfall, Chemical properties, Physical properties, Nutrients, Organic carbon, Trace elements, Biocides, Bacteria, Groundwater recharge, Urban runoff, Geology, Aquatic plants, Algae, Reservoir releases, Geomorphology, Water Quality Standards, Santa Clara County, Santa Clara Valley, Guadalupe River, Los Gatos Creek, Coyote Creek, Llagas Creek.

Water quality and streamflow data were collected during 1979-81 water years at 11 sampling stations in Santa Clara Valley to document water quality and streamflow conditions. Factors causing areal and temporal variations in water quality were rainstorms, urban runoff, basin geology and geomorphology, reservoir storage and release of water, runoff from land surrounding ranch houses where livestock is kept, algae and aquatic vascular plants, riparian vegetation, and the dry season from May to November. Bicarbonate was the principal anion and magnesium and calcium were usually the principal cations. Specific conductance and concentrations of dissolved boron generally were less during storms than at other times. Turbidity and concentrations of total nitrite plus nitrate, total phosphorous, suspended organic carbon, and fecal-coliform and fecal-streptococcal bacteria generally were greater during storms than at other times. Concentrations of dissolved trace elements generally were less than 50 micrograms per liter and rarely exceeded 100 micrograms per liter. Organic biocide concentrations were usually less than detection limits. Streams in Santa Clara Valley generally met water quality objectives. Fecal coliform and total coliform bacteria objectives for municipal water supply were the only objectives frequently exceeded. (USGS)
W88-03038

SURFACE-WATER QUALITY OF COAL-MINE LANDS IN RACCOON CREEK BASIN, OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
K. S. Wilson.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigation Report 85-4060, 1985. 61 p, 12 fig, 13 tab, 12 ref.

Descriptors: *Mine drainage, *Water pollution sources, *Ohio, Surface water, Water quality, Coal mines, Data collections, Raccoon Creek.

The Ohio Department of Natural Resources, Division of Reclamation, plans to reclaim abandoned surface mines in the Raccoon Creek watershed in southeastern Ohio. Historic surface water quality data collected from 1975 to 1983 were compiled and analyzed in terms of eight selected mine-drainage characteristics to develop a database for individual subbasin reclamation projects. Surfacewater quality in the Raccoon Creek basin is affected by mine drainage in five subbasins--the East Branch Raccoon Creek basin, the Brushy Creek basin, the Sandy Run basin, the Hewett Fork basin, and the Little Raccoon Creek basin. (USGS)
W88-03041

STATISTICAL EVALUATION OF EFFECTS OF IRRIGATION ON CHEMICAL QUALITY OF GROUND WATER AND BASE FLOW IN THREE RIVER VALLEYS IN NORTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
T. B. Spruill.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4156, 1985. 64 p, 8 fig, 26 tab, 31 ref.

Descriptors: *Irrigation effects, *Groundwater pollution, *Kansas, Water quality, Base flow, Alluvial aquifers, Water pollution sources, Prairie Dog Creek, Republican River, Smoky Hill River.

The chemical quality of groundwater and base flow in three alluvial valleys in Kansas has been changed as a result of 10 or more years of irrigation. Sulfate concentrations in groundwater in the Prairie Dog Creek valley statistically larger during 1981-82 than before irrigation began. Concentrations of calcium, bicarbonate, sulfate, and dissolved solids in groundwater in the Republican River valley and calcium, sodium plus potassium, sulfate, chloride, and dissolved solids in groundwater in the Smoky Hill River valley were significantly larger during 1981-82 than before irrigation began. No significant long-term changes in nitrate concentrations in groundwater were detected in any of the three valleys. Irrigation generally has not caused contamination of groundwater in the alluvium with organic pesticides for which National Primary drinking-water standards have been established. The pesticide 2, 4-D was detected, however, at concentrations of less than 2 micrograms per liter in water from several wells and surface-water sampling sites. (USGS)
W88-03043

GROUND-WATER CONTRIBUTION TO THE SALINITY OF THE UPPER COLORADO RIVER BASIN,
Geological Survey, Lakewood, CO. Water Resources Div.
J. W. Warner, F. J. Heimes, and R. F. Middelburg.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4198, 1985. 113 p, 37 fig, 12 tab, 11 ref.

Descriptors: *Salinity, *Surface-groundwater relationships, *Upper Colorado River Basin, *Colorado, *Utah, *Wyoming, *Colorado River, *Water pollution sources, Base flow, Green River Basin.

A study was conducted to estimate the contribution of groundwater and other natural sources to the salinity of streamflow in the Upper Colorado River Basin. Salt-load estimates were derived from a mass balance using measurements of quantity and quality of base streamflow. Groundwater inflow was considered to represent the bulk of the streamflow during the low-flow winter months. (USGS)
W88-03044

WATER QUALITY IN THE BLUE CREEK ARM OF LAKE EUFAULA AND BLUE CREEK, OKLAHOMA, MARCH-OCTOBER 1978,
Geological Survey, Oklahoma City, OK. Water Resources Div.
J. K. Kurklin.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4039, 1985. 91 p, 17 fig, 13 tab, 29 ref.

Descriptors: *Water quality, *Lakes, *Mine drainage, *Lake Eufaula, Oklahoma, Water pollution sources, Blue Creek, McAlester, Pittsburg County.

Based on samples analyzed for microbiological, biological, major inorganic and minor constituents, water from Blue Creek and the Blue Creek arm of Lake Eufaula, Oklahoma, is suitable for most uses when compared to the water quality standards. Concentrations of most chemical constituents gradually increased from spring to fall. No other seasonal variation could be determined due to the limited duration of the project. The concentrations generally were less than established drinking water standards, with the exception of iron and manganese. Using water quality determinations and biologic indicators, the water from the Blue Creek arm of Lake Eufaula and Blue Creek is: (1) Soft and acidic with little mineral content and conductivity, (2) calm or very slowly moving, and (3) warm and enriched with organic matter. (USGS)
W88-03050

GROUND-WATER QUALITY IN THE SANTA YNEZ VALLEY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
S. N. Hamlin.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4131, 1985. 79 p, 26 fig, 8 tab, 23 ref.

Descriptors: *Groundwater management, *Water quality, *California, Geology, Land use, Conjunctive use, Water use, Monitoring, Well data, Santa Barbara County, Santa Ynez River.

Groundwater quality in the upper Santa Ynez River Valley in Santa Barbara County has degraded due to both natural and anthropogenic causes. The semiarid climate and uneven distribution of rainfall has limited freshwater recharge and caused salt buildup in water supplies. Tertiary rocks supply mineralized water. Agricultural activities (irrigation return flow containing fertilizers and pesticides, cultivation, feedlot waste disposal) are a primary cause of water quality degradation. Urban development, which also causes water quality degradation (introduced contaminants, wastewater disposal, septic system discharge, and land fill disposal of waste), has imposed stricter requirements on water supply quality. A well network was designed to monitor changes in groundwater quality related to anthropogenic activities. Information from this network may aid in efficient management of the groundwater basins as public water supplies, centered around three basic goals. First is to increase freshwater recharge to the basins by conjunctive surface/groundwater use and surface-spreading techniques. Second is to optimize groundwater discharge by efficient timing and spacing of pumping. Third is to control and reduce sources of groundwater contamination by regulating wastewater quality and distribution and, preferably, by exporting wastewaters from the basin. (USGS)
W88-03052

APPLICATION OF A ONE-DIMENSIONAL STEADY-STATE WATER-QUALITY MODEL TO THE SOUTH PLATTE RIVER IN LITTLETON, ENGLEWOOD, AND DENVER, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
N. E. Spahr, and S. R. Blakely.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4124, 1985. 97 p, 40 fig, 19 tab, 27 ref.

Descriptors: *Water assimilative capacity, *Reaeration, *Colorado, *Model studies, Taveltime, Water quality, South Platte River, Denver, Computer models.

The U.S. Geological Survey's one-dimensional steady-state water quality model was used to investigate the effects of the effluent from the Bi-City WWTP (Wastewater Treatment Plant) on the South Platte River. The Bi-City WWTP is operated by the Cities of Littleton and Englewood. The model was calibrated from a 14.5 mile reach for 5-day carbonaceous biochemical oxygen demand, organic, ammonia, nitrite and nitrate using data collected during September 1983. Model verification was completed using data collected during October 1982 and January 1984 for all constituents except nitrite nitrogen. Nitrite nitrogen could not be verified for the cold temperature conditions of January of 1984. Measured benthic sediment oxygen demand used in model ranged from 1.01 to 2.77 grams per square meter per day. Model simulations were made for an estimated 7-day, 10-year discharge of 18 cubic feet per second, upstream from the outfall of the WWTP. Two groups of simulations were made for both warm and cold temperature conditions. In the first group of simulation variations were made in effluent 5-day carbonaceous biochemical oxygen demand concentrations and flow rates. The second group of simulations varied the amount of nitrogen discharged as ammonia and nitrate. The extent of the mixing zone downstream of the WWTP outfall was determined by injecting Rhodamine WT dye into the effluent. The mixing zone was found to extend 0.8 miles during low-flow conditions. (USGS)
W88-03054

WATER-QUALITY CONDITIONS AND AN EVALUATION OF GROUND- AND SURFACE-WATER SAMPLING PROGRAMS IN THE

Group 5B—Sources Of Pollution

LIVERMORE-AMADOR VALLEY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
S. K. Sorenson, P. V. Cascos, and R. L. Glass.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4352, 1985. 34 p, 13 fig, 9 plates, 7 tab, 18 ref.

Descriptors: *Groundwater, *Surface water, *California, *Water quality, Monitoring, Nitrates, Boron, Specific conductance, Dissolved solids, Sampling, Data collections, Livermore-Amador Valley, Alameda Creek, Livermore, Pleasanton.

A program to monitor the ground- and surface water quality in the Livermore-Amador Valley has been operated since 1976. As of 1982, this monitoring network consisted of approximately 130 wells, about 100 of which were constructed specifically for this program, and 9 surface water stations. Increased demand on the groundwater for municipal and industrial water supply in the past has caused a decline in water levels and a gradual buildup of salts from natural surface-water recharge and land disposal of treated wastewater from waste treatment plants. Results of this study identify the salt buildup to be the major problem with the groundwater quality. Established water quality objectives for dissolved solids are exceeded in 52 of 130 wells. Concentrations of dissolved nitrate are also in excess of basin objectives and health standards. Water quality in both surface and groundwater is highly variable areally. Magnesium to calcium magnesium bicarbonate groundwater are found in the areas where most of the high volume municipal wells are located. Large areas of sodium bicarbonate water occur in the northern part of the valley. Except for two stations on Arroyo Las Positas which has sodium chloride water, surface water is mixed-cation bicarbonate water. (USGS)
W88-03058

DELINEATING RECHARGE AREAS FOR STRATIFIED-DRIFT AQUIFERS IN CONNECTICUT WITH GEOLOGIC AND TOPOGRAPHIC MAPS,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03062

WATER RESOURCES APPRAISAL OF THE CAMP SWIFT LIGNITE AREA, CENTRAL TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
J. L. Gaylord, R. M. Slade, L. M. Ruiz, C. T. Welborn, and E. T. Baker.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4333, 164 p, 33 fig, 8 tab, 32 ref.

Descriptors: *Coal mining, *Hydrologic data, *Environmental effects, *Texas, Leakage, Groundwater, Surface water, Water pollution sources, Camp Swift, Bastrop County, Coastal Plain Province.

The Camp Swift area, Texas was studied to describe the hydrogeology and to provide baseline data of the groundwater and surface water resources that would be affected by the strip mining of lignite. The investigation was centered on the 18-square mile Camp Swift Military Reservation where a reported 80 to 100 million short tons of commercially mineable lignite occurs within 200 feet of the land surface. Groundwater data showed that water levels in observation wells changed only slightly and that the water quality in the Calvert Bluff Formation, which contains the lignite, and in the Simsboro Formation, which is the major aquifer beneath the Calvert Bluff, is suitable for most uses. Big Sandy Creek, which crosses Camp Swift generally has a base flow of less than 0.5 cu ft/sec and infrequently is dry. Dogwood Creek, which originates on Camp Swift, usually is dry. The flow of both streams changes rapidly in response to rainfall in the watersheds. The quality of the water in both streams generally is suitable for most uses. A lithologic examination of 255 feet of cored section that represents the overburden and the lignite showed cyclic layering of fine sand, silt, clay, and lignite. Chemical analyses indicate that the pyritic sulfur concentration is small but variable. (USGS)
W88-03064

HYDROLOGIC AND MICROMETEOROLOGIC DATA FROM AN UNSATURATED ZONE STUDY AT A LOW-LEVEL RADIOACTIVE WASTE BURIAL SITE NEAR BARNWELL, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03071

GROUNDWATER-QUALITY DATA FOR PICATINNY ARSENAL, NEW JERSEY, 1958-85,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03075

DISCHARGE AND WATER QUALITY OF HORSE CREEK, SOUTHEASTERN WYOMING, MAY-NOVEMBER 1985,
Geological Survey, Casper, WY. Water Resources Dib
For primary bibliographic entry see Field 2E.
W88-03086

MAP OF CALIFORNIA SHOWING DISTRIBUTION OF SELENIUM CONCENTRATIONS IN WELLS SAMPLED BY THE U.S. GEOLOGICAL SURVEY, 1975-1985,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03088

RUNOFF CHARACTERISTICS AND WASHOFF LOADS FROM RAINFALL-SIMULATION EXPERIMENTS ON A STREET SURFACE AND A NATIVE PASTURE IN THE DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
M. H. Mustard, S. R. Ellis, and J. W. Gibbs.
Available from USGS, OFSS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-820, 1985. 44 p, 21 fig, 10 tab, 10 ref.

Descriptors: *Urban runoff, *Rainfall-runoff relationships, *Water quality, *Water pollution sources, *Colorado, Land use, Urban water quality.

Rainfall-runoff simulation studies were conducted in conjunction with the Denver Regional Urban Runoff Program to: (1) Compare runoff characteristics from two different intensities of simulated rainfall on street-surface plots, (2) document a first flush of constituent washoff loads in runoff from 1,000-sq-ft street-surface plots, (3) compare runoff characteristics from the street surface plots with those from a 69-acre urban mixed land use subjected to natural rainfall, (4) perform statistical analysis of washoff loads, and (5) compare quantity and quality of runoff from 400-sq-ft plots of native pasture subjected to simulated rainfall and from a 405-acre basin of native pasture subjected to natural rainfall. Experiments on the street surface showed that higher intensity simulated rainfall produced a higher percentage of runoff than lower intensity rainfall, and a first flush of constituent loads occurred for most constituents. The event mean constituent concentrations in the street-surface runoff from simulated storms were generally much smaller than those in the runoff from an adjacent urban basin. Simulated rainfall in small native pasture plots produced runoff-to-rainfall ratios similar to runoff-to-rainfall ratios from a larger native pasture subject to natural rainfall. (USGS)
W88-03091

IOWA GROUNDWATER MONITORING PROGRAM,
Geological Survey, Iowa City, IA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03094

SELECTED WATER-QUALITY DATA FOR THE SAN JOAQUIN RIVER AND ITS TRIBUTARIES, CALIFORNIA, JUNE TO SEPTEMBER 1985,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W88-03097

GROUNDWATER HYDROLOGY OF ELK RIVER BASIN, WEST VIRGINIA,
Geological Survey, Charleston, WV. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03099

HYDROGEOLOGY, DIGITAL SOLUTE-TRANSPORT SIMULATION, AND GEOCHEMISTRY OF THE LOWER CRETACEOUS AQUIFER SYSTEM NEAR BALTIMORE, MARYLAND,
Geological Survey, Towson, MD. Water Resources Div.
F. C. Chapelle, and T. M. Kean.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. Maryland Geological Survey Report of Investigations 43, 1985. 122 p, 35 fig, 12 tab, 36 ref.

Descriptors: *Artesian aquifers, *Coastal Plain, *Geochemistry, *Solute transport, *Maryland Coastal Plain, Chemical precipitation, Anne Arundel County, Baltimore County, Baltimore City, Patuxent aquifer, Patapsco aquifer.

The hydrogeology and groundwater geochemistry of the Patuxent and Patapsco aquifers (Lower Cretaceous) near Baltimore, Maryland, have been investigated. The Patuxent aquifer unconformably overlies Precambrian basement rocks and consists primarily of medium- to coarse-grained quartz sand and gravel. In this area, the Patuxent aquifer attains a thickness of 250 feet and transmissivities range from 2,000 to 6,000 feet squared per day. The Arundel Formation conformably overlies the Patuxent aquifer. The Arundel is composed predominantly of clay and ranges from 0 to 150 feet thick. This unit acts as the upper confining bed to the Patuxent aquifer. The Patapsco aquifer uncomformably overlies the Arundel Formation and is a medium- to fine-grained quartz sand. The Patapsco functions as a water-table aquifer in much of the project area. Brackish-water contamination of the Patuxent aquifer has been a major water-quality problem since the early 1900's. The Patuxent aquifer presently exhibits a circular plume of brackish-water contamination about 5 miles in diameter that is centered on the Baltimore Harbor district. Borehole data demonstrate that the Arundel Formation has been breached by Pleistocene river channels near the Harbor district. The erosional channels provide a conduit for brackish water to leak into the Patuxent aquifer. A two-dimensional areal solute-transport model of the Patuxent aquifer was constructed. This model was used to estimate the future movement of the brackish-water plume based on alternative scenarios of aquifer use. This analysis indicates that the future movement of the chloride plume will probably be very slow. (USGS)
W88-03101

STUDY AND INTERPRETATION OF THE CHEMICAL CHARACTERISTICS OF NATURAL WATER--3RD EDITION,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W88-03112

GAS-FILM COEFFICIENTS FOR THE VOLATILIZATION OF KETONES FROM WATER,
Geological Survey, NSTL Station, MS. Water Resources Div.
R. E. Rathbun, and D. Y. Tai.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Supply Paper 2286, 1986. 36 p, 27 fig, 20 tab, 84 ref.

Descriptors: *Organic compounds, *Vaporization, *Vapor pressure, *Gas film coefficient, *Ketones, *Volatilization, Mass transfer, Streams, Temperature, Volatility, Gas-film resistance, Hydrogen bonding, Two-film model.

Volatilization fluxes for acetone, 2-butanone, 2-pentanone, 3-pentanone, 4-methyl-2-pentanone, 2-heptanone, and 2-octanone were measured in the laboratory over a range of temperatures. Gas-film coefficients for volatilization of these ketones from water were calculated from the volatilization fluxes and vapor pressure data from the literature. Several equations for predicting the volatilization flux and the gas-film coefficient as a function of vapor pressure, temperature, and molecular weight were developed. Four factors based on equations from the literature combining volatilization flux with vapor pressure, molecular weight, temperature, and molecular diffusion coefficient were not constant for the ketones as predicted by theory. Two equations from the literature commonly used for describing the dependence of the gas-film coefficient on molecular weight and the molecular diffusion coefficient were not applicable to the ketone gas-film coefficients. Combination of the ketone gas-film coefficients with gas-film coefficients for the evaporation of water measured under identical experimental conditions resulted in ratios which can, when combined with an equation from the literature, be used to predict gas-film coefficients for the volatilization of these ketones from streams and rivers. (USGS)
W88-03113

INVESTIGATION OF THE POSSIBLE FORMATION OF DIETHYLNITROSAMINE RESULTING FROM THE USE OF RHODAMINE WT DYE AS A TRACER IN RIVER WATERS,
Geological Survey, Denver, CO. Water Resources Div.
T. R. Steinheimer, and S. M. Johnson.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. Supt Doc, USGPO, Wash, DC 20402. In: USGS Water-Supply Paper 2290, 1986. p 37-50, 7 fig, 1 tab, 34 ref.

Descriptors: *Dyes, *Nitrites, *Tracers, *Water pollution sources, *Path of pollutants, *Nitrosamines, *Carcinogens, Organic compounds, Water analysis.

Surface water contamination by nitrosamines formed from rhodamine WT and nitrite ion has been studied. A method for residue analysis of N,N-diethyl-N-nitrosamine (NDEA) has been developed and evaluated using river samples spiked with rhodamine WT and nitrite ion. It permits determination of NDEA at a minimum concentration of 0.03 microgram per liter, using solid-phase extraction and capillary gas chromatography with N-P detectors. River conditions under which rhodamine WT is introduced into a stream for time-of-travel or dispersion studies were simulated in laboratory experiments. Results show that nitrosamine formation did not occur in the spiked river samples at concentrations typically encountered during dye injection studies. At high nitrite concentrations, small amounts of nitrosamine may form, but atypical conditions were not studied here. NDEA persistence in river water was determined by monitoring the rate of its disappearance from a spiked sample. At a concentration of approximately two micrograms per liter, the half-life of the nitrosamine at 20 C is less than three hours at pH8. Samples were collected from four rivers during dye injections and analyzed for NDEA. Results indicate that, under customary dye-study practices, the use of rhodamine WT does not constitute an environmental hazard. (USGS)
W88-03115

INVESTIGATIONS OF ORGANIC CONTAMINANTS DERIVED FROM WOOD-TREATMENT PROCESSES IN A SAND AND GRAVEL AQUIFER NEAR PENSACOLA, FLORIDA,
Geological Survey, Denver, CO. Water Resources Div.
W. E. Pereira, and C. E. Rostad.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. Supt Doc, USGPO, Wash, DC 20402. In: USGS Water-Supply Paper 2290, 1986. p 65-80, 7 fig, 9 tab, 17 ref.

Descriptors: *Water pollution sources, *Creosote, *Pentachlorophenol, Organic compounds, Aquifers, Groundwater, Gas chromatography, Mass spectrometry.

Discharge of effluent wastes containing cresote and pentachlorophenol into surface impoundment sat a wood-treatment facility has resulted in contamination of a sand and gravel aquifer near Pensacola, Florida. Six sites, consisting of three to five wells clustered per site, were sampled to study changes in groundwater chemistry downgradient of the impoundments, and to define background concentrations of organic contaminants. Vertical and horizontal distributions of concentrations of dissolved organic carbon indicated the presence of a contaminant plume that had moved a considerable distance from the source of contamination. Analysis of groundwater by gas chromatography-mass spectrometry near the source of contamination revealed the presence of approximately 84 organic contaminants. Classes of compounds identified included phenols, polycyclic aromatic hydrocarbons, and heterocycles, containing oxygen, nitrogen, and sulfur. A selected number of compounds from each chemical class was quantified in groundwater samples. Vertical and horizontal distributions of phenols, polycyclic aromatic hydrocarbons, and heterocycles indicated the presence of an 'oil-zone,' a main contaminant plume, and a secondary contaminant plume. Two explanations for the presence of the secondary contaminant plume are postulated. The secondary contaminant plume may have its origin in a discharge-interrupt event or result from 'up-coning' of the contaminant plume in the vicinity of a perennial stream. Results of this study indicate that, in aquifer materials of low organic-carbon content (<0.1%), processes such as sorption are relatively insignificant, resulting in the migration of different classes of organic compounds en masse through the porous medium. (USGS)
W88-03117

EVALUATION OF A SUGGESTED SEQUENCE FOR THE CHEMICAL EXTRACTION OF SOLUBLE AMORPHOUS PHASES FROM CLAYS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W88-03123

WATER QUALITY ASSESSMENT OF ARVADA RESERVOIR, DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2H.
W88-03128

WATER QUALITY DATA FOR THE GROUNDWATER NETWORK IN EASTERN BROWARD COUNTY, FLORIDA, 1983-1984,
Geological Survey, Miami, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03133

ARSENIC SPECIATION AND WATER POLLUTION ASSOCIATED WITH MINING IN THE COEUR D'ALENE MINING DISTRICT, IDAHO,
Idaho Univ., Moscow. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W88-03161

CHEMICAL EQUILIBRIA TO MODEL VOLATILIZATION OF AMMONIA FROM AQUATIC AND SOIL SYSTEMS,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
L. E. Sommers.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-167673/AS. Price codes: A02 in paper copy, A01 in microfiche. Purdue Univ. Water Resources Research Center, West Lafayette, IN, Technical Report No. 175, October 1985. 22 p, 2 tab, 7 fig, 8 ref. Contract No. 14-08-0001-G-905. Project No. USGS G905-02.

Descriptors: *Path of pollutants, *Fate of pollutants, *Nitrates, Ammonium, Pollution, Ion exchange, Soils, Soil water.

Laboratory studies and theoretical calculations were performed to study the equilibrium chemistry of ammonia in aqueous solutions representing those found in natural waters and in the soil solution. The objectives of the study were to determine the selectivity coefficient for calcium-ammonium exchange on a soil separate under controlled laboratory conditions. The Vaneslow convention was used to describe the exchange reaction between soluble ammonium and calcium on an exchange phase isolated from a Chalmers silt loam soil. Use of nitrate salts for calcium and ammonium minimized any soluble complex formation during exchange studies. The selectivity coefficient for ammonium-calcium exchange ranged from 0.1 to 0.5 at a total normality of 0.05 equivalents per liter. Calcium is thus preferentially held on the soil solid phase studied. A series of theoretical calculations were also conducted to evaluate the potential for ammonia loss from aqueous solutions treated with different ammoniacal compounds and also containing calcium carbonate or an exchange phase. (USGS)
W88-03170

PREDICTING THE ADVECTIVE FLOW VELOCITY IN A CONFINED AQUIFER USING A SINGLE WELL TRACER TEST,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
P. G. Kaplan, and D. I. Leap.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-167715/AS. Price codes: A04 in paper copy, A01 in microfiche. Technical Report No. 171. September 1985. 51 p, 6 tab, 12 fig, 20 ref. Contract No. 14-08-0001-G905. Project No. USGS G905-03.

Descriptors: *Path of pollutants, *Groundwater movement, Porous flow velocity, Well discharge, Tracers, Sand tank models.

A study was conducted to determine the form of the solution required to solve for the advective flow velocity in a porous medium where observation is limited to a single penetrating well. An analytical equation expressing advective flow velocity as a function of well discharge and arrival time of an injected tracer was derived for a confined aquifer. The modelling process used to derive the velocity equation is described. An experiment was conducted to test the accuracy of the velocity equation at the laboratory scale. A sodium chloride tracer was injected into a sand tank model of a confined aquifer, allowed to drift, and then recovered through a miniature well. Initial results suggest that the equation is accurate using the methods described to obtain data. Field testing is suggested. The stochastic properties of velocity are discussed as an aid to solving contaminant transport problems. A method for fitting a probability density function to the expected value of velocity is illustrated. (Cushman-Water Resources Res. Cr., Purdue U.)
W88-03171

EVALUATION OF NITROGEN APPLICATION TECHNIQUE AND TILLAGE SYSTEM ON NITROGEN RUNOFF FROM AN ERODIBLE SOIL,
Purdue Univ., Lafayette, IN. Water Resources Research Center.

C. A. Lembi, M. D. Britton, and M. A. Ross.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-167699/AS. Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. 174. December 1985. 41 p, 5 tab, 2 fig, 18 ref. Contract No. 14-08-0001-G905. Project No. USGS G905-04.

Descriptors: *Runoff, *Tillage treatments, *Nitrogen, *Soil erosion, *Water pollution sources, Path of pollutants.

Runoff studies were initiated in May 1985 on a highly erodible soil with slopes ranging from 4.6% to 13.8%. 100 sq ft plots were divided into two tillage treatments: (1) no till and (2) conventional plow system. Within each tillage treatment, three nitrogen application techniques were used: (1) surface application of ammonium nitrate pellets (33.5% N), (2) injected anhydrous ammonia, and (3) injected anhydrous ammonia stabilized with the nitrification inhibitor nitrapyrin. A fourth set of plots was let unfertilized. All application rates were at 200 lbs nitrogen per acre. Runoff of water and sediment was greater from the conventional till plots than no till plots at all three dates. Results of this and a 1984 study on these same plots suggest, however, that water runoff from no till areas can be as high or higher than from conventional areas when the soil is dry. In both years, the significant contribution of no till was the reduction of soil loss. Tillage system did not have a significant effect on the majority of nitrogen parameters measured, although the amount of nitrogen moving off the plots was generally greater from the conventional till areas than from no till areas. Nitrogen application technique had a much stronger influence on the movement of NO3-N and NH3-N than on the organic or soil-bound nitrogen. Inorganic nitrogen movement was significantly greater from surface applications. Movement of inorganic nitrogen from injected and injected stabilized plots was minimal and not significantly different from that moving off untreated control areas. (USGS)
W88-03172

ACIDIFICATION OF FOREST SOILS: MODEL DEVELOPMENT AND APPLICATION FOR ANALYZING IMPACTS OF ACIDIC DEPOSITION IN EUROPE,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 5C.
W88-03195

RELATIONSHIPS OF RAINFALL, RIVER FLOW, AND SALINITY TO FAECAL COLIFORM LEVELS IN A MUSSEL FISHERY,
Department of Health, Wellington (New Zealand).
For primary bibliographic entry see Field 5C.
W88-03199

SIMULATION OF ATMOSPHERIC ACID DEPOSITION ON A REGIONAL SCALE,
Institute for Atmospheric Physics, Budapest (Hungary).
For primary bibliographic entry see Field 2B.
W88-03212

PREDICTION OF HEAVY METAL LEACHING RATES FROM STABILIZED/SOLIDIFIED HAZARDOUS WASTES,
New Hampshire Univ., Durham. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W88-03239

COMPARISON OF THE SORPTION/DESORPTION CAPACITY OF A SPENT OIL SHALE AND A WESTERN SOIL,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W88-03256

PREDICTED VS. MEASURED AIR EMISSIONS OF VOLATILE ORGANICS FROM A SIMULATED HAZARDOUS LIQUID WASTE LAGOON,
Chemical Industry Inst. of Toxicology, Research Triangle Park, NC.
L. R. Berrafato, and R. A. Wadden.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 515-525, 2 fig, 6 tab. NIOSH Grant No. 5-T150H7104.

Descriptors: *Fate of pollutants, *Volatile organics, *Wastewater lagoons, *Chemical analysis, *Simulation analysis, *Model testing, *Hazardous materials, Organic solvents, Organic compounds, Toluene, Chlorobenzene, Volatility, Lagoons, Evaporation, Chemical evaporation, Prediction, Mathematical equations, Theoretical models, Model studies.

The evaporation of aqueous solutions of toluene and chlorobenzene, two volatile chemicals which are representative of the organics found in wastewaters, were measured under natural environmental conditions. The observed emission rates and air concentrations were compared with those calculated from representative theoretical models. Appropriate mathematical equations were presented. Two separate types of chemical loss were observed. Early losses due to evaporation from the surface and globules settling to the bottom occurred too quickly to permit discrimination of the mass transfer mechanisms. However, the magnitude of this loss and how the manner and frequency of chemical additions affects total release of material must be taken into account in prediction models. The models for estimating mass transfer coefficients discussed appeared to be reasonable in terms of orders of magnitude estimates for the longer time intervals, but a more complex model is needed which takes globule formation and early high evaporation rates into account. (See also W88-03223) (Wood-PTT)
W88-03263

ANOXIC TRANSFORMATIONS OF TRACE HALOGENATED ALIPHATICS,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
E. J. Bouwer, J. P. Wright, and G. D. Cobb.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 545-553, 4 tab, 9 ref. EPA Grant No. EPA-R-811345010.

Descriptors: *Organic compounds, *Anoxic transformations, *Fate of pollutants, *Water pollution control, *Water quality control, Halogens, Microbial transformation, Biotransformation, Aliphatic halogenated hydrocarbons, Denitrification, Methanogenesis, Sulfate respiration.

Microbial transformation is recognized as playing a significant role in the fate of organic pollutants in aquatic environments. An important environmental factor in biotransformation is the electron acceptor available to microorganisms for deriving energy from an electron donor. Previous studies showed that several chlorinated benzenes near 10 micrograms/liter could be biotransformed under aerobic conditions and that some low-molecular weight halogenated aliphatic compounds at concentrations of 10 to 30 micrograms/liter were stable in the presence of an aerobic biofilm, and could be transformed under methanogenic conditions. Because little is known about the transformability of these compounds under redox conditions between aerobic respiration and methanogenesis, laboratory studies of the biotransformation of volatile halogenated aliphatics under different anoxic electron acceptor conditions related to aquatic environments were performed. It was shown that several potentially hazardous halogenated organic compounds can be transformed even when present in very low concentrations within a 2.5 -day detention time. As the environment became more oxidizing, some of the halogenated aliphatic compounds tended to persist. The data suggest that biotransformation may be an important removal mechanism for some halogenated aliphatic compounds present in low concentrations in anoxic environments. (See also W88-03223) (Wood-PTT)
W88-03265

SIMULATION OF RUNOFF AND NITROGEN LEACHING FROM TWO FIELDS IN SOUTHERN SWEDEN,
Sveriges Meteorologiska och Hydrologiska Inst., Norrkoeping.
For primary bibliographic entry see Field 2E.
W88-03277

HIGH MOLECULAR WEIGHT HYDROCARBONS IN PARTICULATE MATTER OF THE NORTHWEST GULF OF MEXICO,
Texas Univ. at Austin, Port Aransas. Port Aransas Marine Lab.
S. A. Macko, J. K. Winters, and P. L. Parker.
Marine Environmental Research MERSDW, Vol. 21, No. 1, p 3-9, 1987. 2 fig, 2 tab, 10 ref. Bureau of Land Management Contract AA550-CT6-17.

Descriptors: *Hydrocarbons, *Water pollution sources, *Path of pollutants, *Fate of pollutants, *Pollutant identification, *Particulate matter, Gulf of Mexico, Suspended solids, Surface water, Aromatic hydrocarbons, Mass spectra.

A study of hydrocarbons suspended in particulate matter isolated from surface waters of the Gulf of Mexico, was conducted in 1977. Baseline concentrations of saturated and aromatic components in that particulate matter which appear to have a petroleum origin prior to recent major spills in the Gulf were documented. Whereas the particulates did not appear to contain pelagic tar and did contain several components with characteristic mass spectra of natural marine hydrocarbons, unequivocal mass spectra of numerous non-pyrogenic polycyclic aromatic hydrocarbons were obtained. Normal alkane concentrations decreased with distance from shore; however, polycyclic aromatic hydrocarbons tended to be more concentrated offshore. This distribution may be related to a shore source near the study site or the result of water mass variations on the shelf. (Author's abstract)
W88-03290

MULTIVARIATE GEOCHEMICAL INVESTIGATION OF TRACE METAL POLLUTION IN KUWAIT MARINE SEDIMENTS,
Kuwait Inst. for Scientific Research, Safat.
O. Samhan, M. Zarba, and V. Anderlini.
Marine Environmental Research MERSDW, Vol. 21, No. 1, p 31-48, 1987. 8 fig, 4 tab, 14 ref.

Descriptors: *Pollutant identification, *Heavy metals, *Trace metals, *Water pollution sources, *Marine sediments, *Sediments, Kuwait, Multivariate analysis, Mathematical studies, Mathematical equations, Silver, Cadmium, Chromium, Copper, Iron, Manganese, Nickel, Lead, Vanadium, Zinc, Mercury, Metals, Coastal waters.

Three multivariate procedures (cluster analysis, discrimination and classification) were used to identify and characterize various types of marine sediments in Kuwait. Samples from 201 offshore locations were first clustered into five types of sediments with different metal concentrations (Ag, Cd, Cr, Cu, Fe, Mn, Ni, Pb, V, Zn, and Hg) and sedimentological characteristics (% TOC, % carbonate, mean grain size and % size fraction < 63 microns). Discriminant functions were then developed in terms of trace metal concentrations to mathematically describe differences between the various sediment types. A classification procedure was also used to calculate the probability that each of 186 additional samples from coastal areas adjacent to suspected point sources of pollution may belong to each of the five sediment types. This analysis identified a sixth type of sediment dominating the area inside and near the entrance of Shuwaikh Port. Characterized by elevated levels of Ag, Cd, Cu, Hg, Pb, and Zn, this type indicated the presence of a high level of metal pollution in the area. (Author's abstract)
W88-03291

INTERSITE, INTRASITE AND INHERENT VARIABILITY OF THE WHOLE SOFT TISSUE ZINC CONCENTRATIONS OF INDIVIDUAL MUSSELS MYTILUS EDULIS: IMPORTANCE OF THE KIDNEY,
Memorial Univ. of Newfoundland, St. John's.
For primary bibliographic entry see Field 5C.
W88-03293

PASSAGE OF POLAR HYDROCARBONS INTO WATER DURING OIL SPILLS,
Akademiya Nauk SSSR, Moscow. Inst. Okeanologii.
O. S. Mochalova, M. P. Nesterova, and N. M. Antonova.
Oceanology ONLGAE, Vol. 26, No. 2, p 184, October 1986. 1 fig, 3 ref.

Descriptors: *Path of pollutants, *Hydrocarbons, *Oil spills, *Solubility, *Fate of pollutants, *Water pollution sources, Water pollution, Pollutants, Chemical analysis, Spectrophotometry, Seawater, Salinity, Saline water.

The solubility of polar hydrocarbons from spilled commercial petroleum products including crude oil, diesel fuel, and marine bunker oil in seawater was determined. The kinetics of the passage of polar components of the oil and petroleum products from the spilled oil film into water were studied. The concentrations of polar hydrocarbons in water were measured by ultraviolet spectrophotometry directly in the water phase. It was found that polar compounds start to dissolve in the water immediately after the oil film reaches the water and that an equilibrium state was reached by the polar hydrocarbons passing from bunker oil and diesel fuel films to water within a day although for crude oil it took longer. The concentration of hydrocarbons when in equilibrium between the film and the water, expressed as a percentage of the total amount of spilled petroleum product, was inversely proportional to the salinity of the seawater for all three types of petroleum products studied. (Wood-PTT)
W88-03297

USE OF ELLIPSOMETRY TO STUDY OIL FILMS ON THE SEA SURFACE,
Akademiya Nauk SSSR, Leningrad. Inst. Okeanologii.
For primary bibliographic entry see Field 5A.
W88-03298

ARSENIC DATA FOR STREAMS IN THE UPPER MISSOURI RIVER BASIN, MONTANA AND WYOMING,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2K.
W88-03304

TIME-OF-TRAVEL AND REAERATION DATA FOR SEVEN SMALL STREAMS IN ALABAMA, JUNE 1983 TO AUGUST 1984,
Geological Survey, Montgomery, AL. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03307

TRAVELTIME AND LONGITUDINAL DISPERSION IN ILLINOIS STREAMS,
Geological Survey, Urbana, IL. Water Resources Div.
J. B. Graf.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 84-468, 1986. 65 p, 36 fig, 15 tab, 18 ref.

Descriptors: *Traveltime, *Average velocity, *Streamflow, *Dispersion, *Mixing, *Tracers, *Illinois, Estimating equations, Dye releases, Dye concentration, Rivers, Pollutants, Longitudinal dispersion, Peak concentration, Passage time.

Twenty-seven measurements of traveltime and longitudinal dispersion in 10 Illinois streams provide data needed for estimating traveltime of peak concentration of a conservative solute, traveltime of the leading edge of a solute cloud, peak concentration resulting from a given quantity of solute, and passage time of solute past a given point on a stream for both measured and unmeasured streams. Traveltime of peak concentration and of the leading edge of the cloud are related to discharge at the downstream end of the reach, distance of travel, and the fraction of the time that discharge at a given location on the stream is equaled or exceeded. Peak concentration and passage time are best estimated from the relation of each to traveltime. In measured streams, dispersion efficiency is greater than that predicted by Fickian diffusion theory. The rate of decrease in peak concentration with traveltime is about equal to the rate of increase in passage time. Average velocity in a stream reach, given by the velocity of the center of solute mass in that reach, also can be estimated from an equation developed from measured values. (USGS)
W88-03308

WATER-QUALITY VARIABILITY IN FOUR RESERVOIRS IN PHILLIPS AND VALLEY COUNTIES, MONTANA, MAY THROUGH AUGUST, 1981,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2H.
W88-03316

QUALITY OF STORMWATER RUNOFF IN THE BLUE RIVER BASIN, MISSOURI AND KANSAS, JULY-OCTOBER AND APRIL-JULY 1982,
Geological Survey, Rolla, MO. Water Resources Div.
D. W. Blevins.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4226, 1986. 131 p, 18 fig,25 tab, 12 ref.

Descriptors: *Stormwater quality, *Urban runoff, *Urban hydrology, *Kansas City, *Blue River, *Missouri, Combined sewer overflows, Metals, Nutrients, Water quality, Water pollution sources, Kansas.

Stormwater-runoff sampling was done at three mainstem stations on the Blue River, Missouri, and three stations on urban tributaries. Concentrations of lead, iron, manganese, zinc, and ammonia nitrogen consistently exceeded Missouri water-quality standards. Many constituents were significantly correlated with large concentrations of suspended sediment from the agricultural areas in the upstream part of the basin. However, mean concentrations of lead increased 200% and mean concentrations of zinc increased 100% in the urban reach of Blue River for some storms. Combined sewer overflows along Brush Creek, one of the urban tributaries, caused large concentrations of nutrients, suspended sediment, metals, and 5-day biochemical oxygen demand in the initial runoff. After extended dry periods, surface flushing caused concentrations of lead and zinc to be largest during initial runoff at all three urban tributaries. However, large flushes of most constituents were not detected at the mainstem stations. The large percentage of impervious surfaces and lined channels in urban areas caused increased volumes of runoff per unit of drainage area and limited the availability of sediment to streams. Consequently, concentrations of most constituents were small, but the loads per unit of drainage area were large when compared with those in Blue River. (USGS)
W88-03317

CONCEPTUAL GROUNDWATER-QUALITY MONITORING NETWORK FOR SAN FERNANDO VALLEY, CALIFORNIA,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03318

WATER-QUALITY CHARACTERISTICS AND NUTRIENTS AND SUSPENDED-SEDIMENT LOADS, CARSON RIVER AND TRUCKEE CANAL, WESTERN NEVADA, WATER YEAR 1980,
Geological Survey, Carson City, NV. Water Resources Div.
K. T. Garcia, and R. L. Carman.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4147, 1985. 107 p, 11 fig, 22 tab, 29 ref.

Descriptors: *Nutrients, *Sediment load, *Reservoirs, *Carson River, *Lahontan Reservoir, *Nevada, *Truckee Canal Load calculations, Load distribution, Path of pollutants, Water quality.

Lahontan Reservoir is a major recreational site in the Carson River basin in western Nevada. The reservoir is fed by the Carson River and by the Truckee Canal which transports water from the adjacent Truckee River. Water quality in both rivers is influenced by agriculture and urbanization. Specific conductance tended to increase in a downstream direction. Generally, pH values ranged from 7.0 to 8.8. Dissolved-oxygen concentrations were greater than 5 milligrams/L. Calcium and sodium were the dominant cations and bicarbonate the dominant anion. Suspended-sediment concentrations ranged from 3 to 1,790 milligrams/L. Ultimate carbonaceous biochemical oxygen demand ranged from 1.2 to 19.6 milligrams/L. The codominant algal groups were the blue-greens, greens, and diatoms. Background total nutrient and suspended-sediment loads were about 490 tons nitrogen, 130 tons phosphorus, and 200,000 tons suspended sediment. Total nutrient and suspended-sediment loads to Lahontan Reservoir were about 980 tons nitrogen, 300 tons phosphorus, and 300,000 tons suspended sediment. Loads to the lower Carson River from the reservoir were about 820 tons total nitrogen, 180 tons total phosphorus, and 26,000 tons suspended sediment. (USGS)
W88-03319

HYDROLOGY OF COAL-LEASE AREAS NEAR DURANGO, COLORADO,
Geological Survey, Grand Junction, CO. Water Resources Div.
T. Brooks.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4125, 1985. 46 p, 11 fig, 4 tab, 12 ref.

Descriptors: *Alluvial aquifers, *Aquifer characteristics, *Geohydrology, *Mine water, *Water quality, *Water pollution sources, *Colorado, Groundwater movement, Subsidence.

The U.S. Bureau of Land Management leases Federal lands and minerals for coal mining near Durango, Colorado. This report addresses the hydrologic suitability of those lands for coal leasing; the report describes the general hydrology of the Durango area and, more specifically, the hydrology of the Stollsteimer Creek study area 32 miles east of the Durango and the Hay Gulch study area, 12 miles southwest of Durango. The most productive aquifers in the Durango study area are Quaternary alluvium and the tertiary Animas Formation. Water wells completed in alluvium typically yield 5 to 20 gallons/min; wells completed is the Animas Formation yield as much as 50 gallons/min. Water quality in these aquifers is variable, but it generally is suitable for domestic use. The coal-bearing Cretaceous Fruitland and Menefee Formations are mined by surface methods at the Chimney Rock Mine in the Stollsteimer Creek study area and by underground methods at the National King Coal Mine in the Hay Gulch study area. Effects of surface mining in the Stollsteimer Creek area are: (1) Dewatering of an alluvial aquifer; and (2) Local degradation of alluvium water quality by spoil-pile effluent. Effects of underground mining in the Hay Gulch area are: (1) Introduction of water with greater dissolved-solids concentrations into the upper Hay Gulch alluvium from mine runoff; (2) Subsidence fracturing which could dewater streams and the alluvial aquifer. (USGS)
W88-03321

PRELIMINARY RESULTS OF THE PREIMPOUNDMENT WATER-QUALITY STUDY OF SWATARA CREEK, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 2H.
W88-03329

SOURCES OF WATER AND NITROGEN TO THE WIDEFIELD AQUIFER, SOUTHWESTERN EL PASO COUNTY, COLORADO,
Geological Survey, Pueblo, CO. Water Resources Div.
P. Edelmann, and D. Cain.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4162, 1985. 81 p, 37 fig, 9 tab, 32 ref.

Descriptors: *Nitrogen, *Groundwater quality, *Alluvial aquifers, *Colorado, *Surface-groundwater relations, *Water pollution sources, Nitrogen transformation, Stream-aquifer system, Groundwater, Path of pollutants, Colorado Springs, Widefield aquifer.

The Widefield aquifer near Colorado Springs, Colorado, is recharged primarily by Fountain Creek and, to a lesser extent, by infiltration and percolation of water from the land surface and from groundwater inflow. During the past 20 to 30 years, concentrations of nitrate (as nitrogen) in the Widefield aquifer have increased from 0.5 to 3.0 milligrams/L to nearly 10 milligrams/L, and occasionally exceed the drinking-water standard of 10 milligrams/L as nitrogen. During the summer of 1982, the concentrations of nitrite plus nitrate as nitrogen in water in the aquifer ranged from 3.2 to 15 milligrams/L with a mean concentration of 6.9 milligrams/L. In general, the nitrite-plus-nitrate concentrations are greatest near the north end of the aquifer, probably resulting from effluent from Colorado Springs Sewage Treatment Plant being discharged to Fountain Creek. During 1982, 93% of the total estimated 160 tons of nitrogen available to enter the Widefield aquifer was from the Colorado Springs Sewage Treatment Plant. However, a significant proportion of this nitrogen may have been lost through denitrification. (USGS)
W88-03330

WATER QUALITY OF RHODE ISLAND STREAMS,
Geological Survey, Boston, MA. Water Resources Div.
J. C. Briggs, and J. S. Feiffer.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4367, 1986. 51 p, 6 fig, 8 tab, 20 ref.

Descriptors: *Water quality, *Streams, *Path of pollutants, *Pesticides, Chemical analysis, Trace elements, Organic compounds, Bottom sediments, Rhode Island, Branch River, Pawtuxet River, Pawcatuck River.

Water quality data collected from November 1979 through September 1983 at five stream stations within Rhode Island and one in Massachusetts show that concentrations of the common constituents were low. Mean water hardness at all sites was in the 'soft' category. Sodium concentrations were less than 20 mg/L at two sites and less than 35 mg/L at the other sites. Mean nitrogen values for the two Blackstone River sites were in the range that could cause undesirable growths of aquatic plants. Mean phosphorus values exceeded the recommended limits for protection of aquatic life at four sites. Trace-element concentrations in the water were generally low. Those trace elements which were found in concentrations near or exceeding any standard or criterion include cadmium, chromium, lead, iron, and manganese. High concentrations of several trace elements were found in the bottom materials at several sites. The bottom materials also contained pesticides and organic chemicals including aldrin, chlordane, DDD, DDE, DDT, dieldren, endosulfan, endrin, heptachlor, Mirex, and PCB. Results of trend analysis of total phosphorus, total nitrogen, and specific conductance show a downward trend in phosphorus at two sites; an upward trend in nitrogen at one site; and one downward trend and one upward trend in specific conductance. (USGS)
W88-03335

REAERATION COEFFICIENTS OF SIX STREAMS IN NEW YORK--A COMPARISON OF RESULTS OBTAINED BY A HYDROCARBON-GAS TRACER METHOD WITH THOSE OBTAINED BY RADIOACTIVE-TRACERS AND PREDICTIVE EQUATIONS,
Geological Survey, Albany, NY. Water Resources Div.
D. A. Stedfast, and R. E. Draper.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4028, 1986. 30 p, 8 fig, 4 tab, 27 ref.

Descriptors: *Instream aeration, *Tracers, *Reaeration, *Oxygenation, *New York, Traveltime, Estimating equations, Comparison studies, Reaeration coefficient, Hydrocarbon tracers, Dye tracing.

Stream-reaeration measurements were made in selected reaches on six streams in New York State from 1978 to 1981 with hydrocarbon-gas and dye tracers. The sites were Canadaigua Outlet near Canadaigua, Oswego River at Fulton, Hudson River at Fort Miller, Cayadutta Creek near Johnstown, Chenango River near Morrisville, and Payne Brook near Hamilton. The reaches represent a wide range of discharge, water-surface slope, velocity, and streambed composition. Flows ranged from less than 2 cu ft/sq on the Chenango River to 4,100 cu ft/sq on the Hudson River, and water-surface slope within the reaches ranged from less than 1 foot/mile on the Hudson and Oswego Rivers to more than 50 ft/mi on Cayadutta Creek. The corresponding stream-reaeration coefficients ranged from 0.77 units/day for one reach on Canadaigua Outlet to 52 units/day on Cayadutta Creek. The reaeration coefficients for Canadaigua Outlet compared well with those obtained on the same reach 10 years earlier by radioactive tracers. Comparison of measured reaeration coefficients with those calculated from 10 predictive equations based on stream-channel characteristics yielded mean errors that range from 51% to 103%. No single equation gave reliable accuracy for all stream reaches. (USGS)
W88-03341

GROUND-WATER CONDITIONS AND LEACHATE MOVEMENT NEAR TWO CHEMICAL-WASTE SITES IN OSWEGO COUNTY, NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
H. R. Anderson, and T. S. Miller.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4148, 1986. 37 p, 15 fig, 7 tab, 15 ref.

Descriptors: *Chemical wastes, *Leachates, *Path of pollutants, *Groundwater pollution, *Groundwater movement, *Toxic wastes, *New York, Water pollution, Glacial aquifers, Water pollution sources, Organic compounds, Heavy metals, Landfills, Oswego County, Landfills.

Forty-five observation wells and test holes were installed at two chemical waste disposal sites in Oswego County, New York, to evaluate the hydrogeologic conditions and the rate and direction of leachate migration. At the site near Oswego groundwater moves northward at an average velocity of 0.4 ft/day through unconsolidated glacial deposits and discharges into White Creek and Wine Creek, which border the site and discharge to Lake Ontario. Leaking barrels by chemical wastes have contaminated the groundwater within the site, as evidenced by detection of 10 'priority pollutant' organic compounds, and elevated values of specific conductance, chloride, arsenic, lead, and mercury. At the site near Fulton, where 8,000 barrels of chemical wastes are buried, groundwater in the sandy surficial aquifer bordering the landfill on the south and east moves southward and eastward at an average velocity of 2.8 ft/day and discharges to Bell Creek, which discharges to the Oswego River, or moves beneath the landfill. Leachate is migrating eastward, southeastward, and southwestward, as evidenced by elevated values of specific conductance, temperature, and concentrations of several trace metals at wells east, southeast, and southwest of the site. (USGS)
W88-03344

AREAL AND TEMPORAL VARIABILITY OF SELECTED WATER-QUALITY CHARACTERISTICS IN TWO HYDROLOGIC-BENCHMARK BASINS IN THE NORTHEASTERN UNITED STATES,
Geological Survey, Harrisburg, PA. Water Resources Div.
R. A. Hainly, and J. R. Ritter.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4025, 1986. 22 p, 6 fig, 9 tab, 8 ref.

Descriptors: *Hydrologic benchmark stations, *Water quality, *Acid rain, *Pennsylvania, *New York, Stream acidity, Monitoring, Water pollution sources, Young Womans Creek, Esopus Creek.

Two U.S. Geological Survey National Hydrologic Benchmark stations--Young Womans Creek near Renovo, Pennsylvania and Esopus Creek at Shandaken, New York--were studied to (1) define, both areally and temporally, variations of stream acidity and other water quality characteristics within the basins; (2) evaluate how well the data collected at the Benchmark station represent the water quality conditions upstream; (3) define relations between streamflow acidity or pH; and (4) provide a data base to detect trends in quality of headwater streams. Samples were collected at nine sites, including the Benchmark station, in each basin for three series of measurements over a range of streamflows. Along with streamflow, samples were analyzed for water temperature, specific conductance, pH, dissolved oxygen, acidity, alkalinity, dissolved sulfate, and dissolved nitrite plus nitrate. The results of the measurements indicated little water quality variation in the Young Womans Creek basin. Therefore, the data collected at the Benchmark station can be used to reflect upstream changes in water quality. The data collected at the Esopus Creek station did not reflect upstream conditions as well as the Young Womans Creek data because the water quality varied throughout the basin. Few strong relations were found between streamflow and the water quality characteristics examined in this study. The Esopus Creek data indicated the possibility of relationships between streamflow and alkalinity, dissolved nitrite plus nitrate, and specific conductance. No relations were found between streamflow and the Young Womans Creek water quality data. (USGS)
W88-03346

GROUND-WATER AVAILABILITY AND WATER QUALITY AT SOUTHBURY AND WOODBURY, CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03348

OCCURRENCE OF GROUND-WATER AND POTENTIAL FOR SEAWATER INTRUSION, ISLAND COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03350

WASTEWATER MOVEMENT NEAR FOUR TREATMENT AND DISPOSAL SITES IN YELLOWSTONE NATIONAL PARK, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
E. R. Cox.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4356, 1986. 81 p, 31 fig, 9 tab, 22 ref.

Descriptors: *Path of pollutants, *Groundwater pollution, *Lagoons, *Groundwater movement, Wells, Streams, Lakes, Water levels, Chlorides,

Nitrites, Nitrates, Specific conductance, Iron, Dye concentrations, Groundwater mounds, Wyoming, Yellowstone National Park.

The U.S. Geological Survey, in cooperation with the National Park Service, studied the effects on nearby streams and lakes of treated wastewater effluents that percolate from sewage lagoons at four sites in Yellowstone National Park. A network of observation wells has been established near the sites, and water level and water quality data were collected from 1974 through 1982. Groundwater mounds occur under the lagoons as percolation of effluents occurs. The percolating effluents mix with groundwater and form plumes of water that contain chemical constituents from the effluents. These plumes move down the hydraulic gradient toward groundwater discharge areas. The directions of movement of percolating effluents have been determined by analyzing water samples from wells near the lagoons for specific conductance, chloride concentration, and nitrite plus nitrate concentration. Other constituents and properties also were determined. The percolating effluents are diluted by groundwater and have no discernible effects on the quality of water in the nearby streams and lakes. (USGS)
W88-03352

ALTITUDE OF THE TOP OF SALINE GROUND WATER IN THE SOUTHEASTERN COASTAL PLAIN,
Geological Survey, Atlanta, GA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W88-03361

TRAVELTIME AND DISPERSION OF A SOLUBLE DYE IN THE SOUTH BRANCH POTOMAC RIVER, WEST VIRGINIA,
Geological Survey, Charleston, WV. Water Resources Div.
A. R. Jack.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4167, 1986. 14 p, 11 fig, 2 tab, 3 ref.

Descriptors: *Traveltime, *Potomac River, *Tracers, *Dye releases, *Path of pollutants, *Dispersion, *West Virginia, *Potomac River Basin, Pollutants, Water use, Concentrations, Mixing, Dilution.

Traveltime studies, using rhodamine dyes, were made in 1970 and 1982 on the South Branch Potomac River from Petersburg, West Virginia, to the confluence with the North Branch Potomac River at Green Spring, West Virginia. Flow duration at the time of the studies was approximately 32% in November 1970 and 95% in September 1982. Two studies, at discharges of 110 and 1,230 cu ft/sec, were used to define traveltime-distance relationships. A contaminant takes 386 hours to travel 69 miles from Petersburg, West Virginia, to the mouth of the river when streamflow is 110 cu ft/sec. The contaminant would, however, take only 89 hours when streamflow is 1,230 cu ft/sec. The traveltime data were interpolated and extrapolated for selected discharges from 70 to 1,500 cu ft/sec at the index gage near Springfield, West Virginia. (USGS)
W88-03362

QUANTITY AND QUALITY OF URBAN STORM RUNOFF IN THE IRONDEQUOIT CREEK BASIN NEAR ROCHESTER, NEW YORK, PART 2,
Geological Survey, Ithaca, NY. Water Resources Div.
W. M. Kappel, R. M. Yager, and P. J. Zarriello.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4113, 1986. 93 p, 22 fig, 20 tab, 60 ref.

Descriptors: *Urban hydrology, *Storm runoff, *Water quality, *Model studies, *Urban runoff, *New York, *Precipitation quality, *Runoff modeling, *Water quality modeling, Wetlands, Water pollution sources, Path of pollutants, Monroe County, Lake Ontario, Irondequoit Creek.

Water quality data collected at 17 sites in urbanized and rural parts of the 438 sq km Irondequoit Creek basin from July 1980 through August 1981 were used to compute annual loads of eight selected constituents. Of the total annual loads of these constituents, 50 to 70% was transported to Irondequoit Bay during a 3.5-month period from late January to early May. Of six mixed-land-use subbasins, the two most highly urbanized had the highest loads of all constituents. Of the four sites representing single land uses, the high density residential site and the housing construction site had the highest loads of all constituents except cadmium. A rainfall-runoff model was used to predict quantity and quality of storm runoff leaving one commercial site, two residential sites, and a large mixed-land-use subbasin. Predicted volume and peak discharges were within 10 to 30% of the measured values; predicted runoff loads of most constituents were within 40 to 60% of measured values. Stormflow modification in the Irondequoit Creek wetlands by two hypothetical control structures was simulated. Results indicate that outflow from the upper wetland could be decreased and stormflows dispersed to a greater part of the upper wetland to increase retention of suspended solids and associated chemical constituents. (USGS)
W88-03363

CHEMICAL COMPOSITION OF GROUND WATER IN THE YUCCA MOUNTAIN AREA, NEVADA--AN UPDATE,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03373

SUMMARY OF SELECTED WATER-QUALITY DATA FOR THE WARRIOR COAL FIELD, ALABAMA,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
W. S. Mooty.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-689, 1985. 68 p, 13 fig, 14 tab.

Descriptors: *Water quality, *Coal mines, *Chemical properties, *Alabama, Surface water, Groundwater, Hydrogen ion concentration, Iron manganese, Hardness, Sulfates, Warrior coal field.

A summary is presented of selected water quality data collected from 1976 to 1984 at 75 surface water sites and 28 test wells in the Warrior coal field in northwestern Alabama. The minimum, maximum, mean or median, standard deviation, and number of determinations are given for each site for discharge, pH, alkalinity, specific conductance, hardness, dissolved and suspended solids, sulfate, and total and dissolved iron and manganese. Twelve quadrangles are included in the report showing the location of each site. (USGS)
W88-03374

QUANTITY AND QUALITY OF STORM RUNOFF IN THE IRONDEQUOIT CREEK BASIN NEAR ROCHESTER, NEW YORK, PART I, DATA-COLLECTION NETWORK AND METHODS, QUALITY-ASSURANCE PROGRAM, AND DESCRIPTION OF AVAILABLE DATA,
Geological Survey, Ithaca, NY. Water Resources Div.
P. J. Zarrielli, W. E. Harding, R. M. Yager, and W. M. Kappel.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 84-610, 1985. 44 p, 10 fig, 11 tab, 11 ref.

Descriptors: *Urban hydrology, *Storm runoff, *Water quality, *New York, Flow discharge, Precipitation, Evaporation, Precipitation quality, Quality control, Monroe County, Irondequoit Creek.

A 14-month data collection program of quantity and quality of storm precipitation and runoff was conducted in the Irondequoit Creek basin, a 438-sq km area along the south shore of Lake Ontario in north-central New York, from July 1980 through August 1981. The data from a basis for study of nutrient inflow to Irondequoit Bay. This report describes the methods used to collect and verify the data and includes some representative examples of the data base. Stream discharge and water quality data were collected at 17 sites representing rural and urban land uses. Precipitation data were collected at five continuous-record gages and 11 daily total gages. Evaporation data were collected at one site; chemical quality of precipitation and dustfall data were collected at four sites. Tables list watershed characteristics, precipitation data (including chemical quality of atmospheric deposition, monthly precipitation, and evaporation), and annual loadings of eight selected nutrients and heavy metals from the five major subbasins and three discrete land-use site. Examples of computer printouts of streamflow, precipitation, and water quality data available from the Geological Survey's WATSTORE computer system are included. (USGS)
W88-03381

HYDROLOGIC, LITHOLOGIC, AND CHEMICAL DATA FOR SEDIMENTS AT TWO SITES IN THE SHALLOW ALLUVIAL AQUIFER NEAR FALLON, NEVADA, 1984-85,
Geological Survey, Carson City, NV. Water Resources Div.
M. S. Lico, A. H. Welch, and J. L. Hughes.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-250, 1986. 43 p, 30 fig, 12 tab, 6 ref.

Descriptors: *Arsenic, *Path of pollutants, *Water pollution sources, *Geochemistry, *Sediments, Drillers logs, Hydraulic conductivity, Mineralogy, Soil chemistry, Selenium, Well data, Fallon, Nevada, Churchill County, Lahontan Valley.

The U.S. Geological Survey collected an extensive amount of hydrogeologic data from the shallow alluvial aquifer at two study sites near Fallon, Nevada, from 1984 though 1985. These data were collected as part of a study to determine the geochemical controls on the mobility of arsenic and other trace elements in shallow groundwater systems. The main study area is approximately 7 miles south of Fallon. A subsidiary study area is about 8 miles east of Fallon. The data collected include lithologic logs and water level altitudes for the augered sampling wells and piezometers, and determinations of arsenic and selenium content, grain size, porosity, hydraulic conductivity, and mineralogy for sediment samples from cores. (USGS)
W88-03392

HYDROLOGIC DATA FOR THE WELDON SPRING RADIOACTIVE WASTE-DISPOSAL SITES, ST. CHARLES COUNTY, MISSOURI--1984-1986,
Geological Survey, Rolla, MO. Water Resources Div.
M. J. Kleeschulte, and L. F. Emmett.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-488, 1986. 61 p, 6 fig, 8 tab, 12 ref.

Descriptors: *Radioactive wastes, *Uranium, *Water quality, *Path of pollutants, *Water pollution sources, *Missouri, Seepage loss, Lithium, Nitrates.

Hydrologic and water quality data were collected during an investigation of the Weldon Spring radioactive waste disposal sites and surroundings area in St. Charles County, Missouri, from 1984 to 1986. The data consists of water quality analyses of samples collected from 45 groundwater and 27 surface water sites. This includes analyses of water from four raffinate pits and from the Weldon Spring quarry. Also included in the report are the results of a seepage run on north flowing tributaries to Dardenne Creek from Kraut Run to Crooked Creek. Mean daily discharge from April 1985 to April 1986 is given for two springs located about 1.5 mi north of the chemical plant. (USGS)
W88-03398

SELECTED HYDROLOGIC DATA FROM A WASTEWATER SPRAY DISPOSAL SITE ON HILTON HEAD ISLAND, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
G. K. Speiran, and D. L. Belval.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-189, 1985. 34 p, 11 fig, 3 tab.

Descriptors: *Water quality, *Groundwater, *Wastewater disposal, *South Carolina, Wastewater irrigation, Nutrient, Dissolved solids, Hilton Head Island, Beaufort County, Land disposal.

This study presents data collected during a study of the effects on the water table aquifer from wastewater application at rates of up to 5 inches per week on a wastewater spray disposal site on Hilton Head Island, South Carolina. The study was conducted from April 1982 through December 1983. The disposal site covers approximately 14 acres. Water level and water quality data from organic, inorganic, and nutrient analyses from the water table aquifer to a depth of 30 ft and similar water quality data from the wastewater treatment plant are included. (USGS)
W88-03414

SIMULATED EFFECTS OF SURFACE COAL MINING AND AGRICULTURE ON DISSOLVED SOLIDS IN THE REDWATER RIVER, EAST CENTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
R. F. Ferreira, and J. H. Lambing.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4180, 1985. 69 p, 5 fig, 30 tab, 39 ref.

Descriptors: *Coal mines, *Strip mines, *Water pollution sources, *Montana, Dissolved solids, Irrigation effects, Redwater River.

Dissolved solids concentrations in five reaches of the Redwater River in east-central Montana were simulated to evaluate the effects of surface coal mining and agriculture. A mass-balance model of streamflow and dissolved solids load developed for the Tongue River in southeastern Montana was modified and applied to the Redwater River. Mined acreages, dissolved solids concentrations in mined spoils, and irrigated acreage can be varied in the model to study relative changes in the dissolved solids concentration in consecutive reaches of the river. Because of extreme variability and a limited amount of data, the model was not consecutively validated. Simulated mean and median monthly mean streamflows and consistently larger than those calculated from streamflow records. Simulated mean and median monthly mean dissolved solids loads also are consistently larger than regression-derived values. These discrepancies probably result from extremely variable streamflow, overestimates of streamflow from ungaged tributaries, and weak correlations between streamflow and dissolved solids concentrations. The largest increases in simulated dissolved solids concentrations from mining and agriculture occur from September through January because of smaller streamflows and dissolved solids loads. Different combinations of agriculture and mining under mean flow conditions resulted in cumulative percentage increases of dissolved solids concentrations of less than 5% for mining and less than 2% for agriculture. (USGS)
W88-03419

SOURCE OF SEAWATER INTRUSION AT TAHOLAH AND ADJACENT GROUND-WATER CONDITIONS, QUINAULT INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
B. W. Drost.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4361, 1985. 26 p, 4 fig, 3 tab, 4 ref.

Descriptors: *Geohydrology, *Saline water intrusion, *Washington, Groundwater, Tidal effects, Test holes, Groundwater movement, Groundwater availability, Quinault River, Quinault Indian Reservation.

Several wells drilled to supplement the spring-fed water supply of the town of Taholah, in the Quinault River Valley, Washington, yielded water with chloride concentrations greater than 300 milligrams/L. Therefore, a study was conducted to define the movement and quality of the groundwater system at Taholah and at alternative well sites in adjacent areas. Results showed that during low tide, groundwater flows from Taholah northward to the river and westward to the ocean. During high tide water flows into the groundwater system along all margins of Taholah, causing a mounding of the underlying water table; the only outflow is seaward, probably at a depth of 60 to 75 ft below sea level. Marine water moves as far as 1.5 up the Quinault River during periods of combined high and low streamflow, and 0.5 mi during high tide and moderate streamflow, introducing large quantities of salty water into groundwater system and precluding its use as a water supply source. Unconsolidated glacial deposits and underlying Tertiary siltstones southeast of Taholah are not an adequate source for the community's water needs. However, coarse-grained unconsolidated materials lying farther east along the Quinault River may be capable of supplying the anticipated need of about 300 gallons/min. (USGS)
W88-03425

HYDROGEOLOGY, GROUND-WATER FLOW, AND TRITIUM MOVEMENT AT A LOW-LEVEL RADIOACTIVE-WASTE DISPOSAL SITE NEAR SHEFFIELD, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
G. Garklavs, and R. W. Healy.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4153, 1986. 35 p, 15 fig, 2 tab, 10 ref.

Descriptors: *Path of pollutants, *Radioactive waste disposal, *Geohydrology, *Groundwater movement, *Tritium, *Illinois, Computer models, Traveltime, Sheffield.

Groundwater flow and tritium movement are described at and near a low-level radioactive waste disposal site near Sheffield, Illinois. Flow in the shallow aquifer is confined to three basins that ultimately drain into a stripmine lake. Most of the flow from the site is through a buried, pebbly sandfilled channel. Remaining flow is toward alluvium of an existing stream. Conceptual flow models for the two largest basins are used to improve definition of flow velocity and direction. Flow velocities range from about 25 to 2,500 ft/yr. Tritium was found in all three basins. The most extensive migration of tritium is coincident with buried channel. Tritium concentrations ranged from detection level to more than 300 nanocuries/L. (USGS)
W88-03427

OCCURRENCE OF DISSOLVED SODIUM IN GROUND-WATERS OF BASALTS UNDERLYING THE COLUMBIA PLATEAU, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
G. C. Bortleson, and S. E. Cox.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4005, 1986. 24 p, 5 fig, 6 plates, 2 tab, 11 ref.

Descriptors: *Groundwater, *Groundwater quality, *Groundwater chemistry, *Washington, Basalts, Sodium, Irrigation water, Columbia River Basalt Group, Basalt aquifers.

Basalt aquifers of the Columbia River Basalt Group are a principal source of water for agricultural, domestic, and municipal use. Concern has been expressed in this agriculture-dependent region about problems associated with the use of groundwaters with a high sodium concentration relative to the calcium and magnesium content (high sodium-adsorption ratio). Continued irrigation with such waters can reduce soil permeability to the degree that water cannot effectively reach plant roots. Groundwaters within a flow path evolved from a calcium magnesium bicarbonate type in shallow and upgradient locations to a sodium potassium bicarbonate type in deeper and downgradient locations. Most of the intermediate and high sodium adsorption ratio values were observed in discharge areas near major streams and in pumping centers within the central part of the plateau. Ninety-six percent of the groundwaters sampled had a low sodium absorption ratio, indicating that, for irrigation purposes, there is probably little danger of harmful levels of exchangeable sodium occurring on soil. However, water from 18 of 418 wells sampled had a sodium absorption ratio grater than 8.0 and were classified as having a medium, high, or very high sodium hazard. (USGS)
W88-03428

CONCEPTS AND DATA-COLLECTION TECHNIQUES USED IN A STUDY OF THE UNSATURATED ZONE AT A LOW-FIELD RADIOACTIVE-WASTE DISPOSAL SITE NEAR SHEFFIELD, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
R. W. Healy, M. P. deVries, and R. G. Striegl.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4228, 1986. 37 p, 11 fig, 49 ref.

Descriptors: *Radioactive waste disposal, *Unsaturated flow, *Path of pollutants, *Groundwater movement, *Illinois, Evapotranspiration, Geochemistry, Carbon-14, Bureau County, Sheffield.

A study of water and radionuclide movement through the unsaturated zone is being conducted at the low level radioactive waste disposal site near Sheffield, Illinois. Included in the study are detailed investigations of evapotranspiration, movement of water through waste trench covers, and movement of water and radionuclides (dissolved and gaseous) from the trenches. An energy balance/Bowen ratio approach is used to determine evapotranspiration. Precipitation, net radiation, soil-heat flux, air temperature and water vapor content gradients, wind speed, and wind direction are measured. Soil water tension is measured with tensiometers which are connected to pressure transducers. Meteorological sensors and tensiometers which are connected to pressure transducers. Meteorological sensors and tensiometers are monitored with automatic data loggers. Soil moisture contents are measured through small-diameter access tubes with neutron and gamma-ray attenuation gages. Data beneath the trenches are obtained through a 130-meter-long tunnel which extends under four of the trenches. Water samples are obtained with suction lysimeters, and samples of the geologic material are obtained with core tubes. These samples are analyzed for radiometric and inorganic chemistry. Gas samples are obtained from gas piezometers and analyzed for partial pressures of major constituents, Radon-222, tritiated water vapor, and carbon-14 dioxide. (USGS)
W88-03437

EFFECTS OF OCTOBER 1981 FLOOD ON THE QUANTITY AND QUALITY OF WATER IN SELECTED STREAMS AND RESERVOIRS IN THE BRAZOS RIVER BASIN, TEXAS,
For primary bibliographic entry see Field 2A.
W88-03446

GROUND-WATER QUALITY AND GEOCHEMISTRY OF AQUIFERS ASSOCIATED WITH COAL IN THE ALLEGHENY AND MONONGAHELA FORMATIONS IN SOUTHEASTERN OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 2K.
W88-03447

HYDROLOGY OF LAKE BUTLER, ORANGE COUNTY, FLORIDA,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03448

CONTROLS ON GROUND-WATER CHEMISTRY IN THE HORSE HEAVEN HILLS, SOUTH-CENTRAL WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W88-03449

HYDROLOGY OF AREA 54, NORTHERN GREAT PLAINS AND ROCKY MOUNTAIN COAL PROVINCES, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.
G. Kuhn, P. B. Daddow, and G. S. Craig.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 83-146, 1983. 94 p, 78 fig, 18 tab, 173 ref.

Descriptors: *Hydrology, *Coal mining, *Rock Mountain coal province, *Colorado, *Wyoming, Surface water, Groundwater, Water quality, Hydrologic data, Coal, Baseline studies, Gaging stations, Albany County, Carbon County, Jackson County, Larimer County, North Park, Hanna Basin, Laramie Basin, Saratoga Valley, North Platte River, Medicine Bow River, Laramie River.

Coal area 54, in north-central Colorado and south-central Wyoming, is one of contrasting geology, topography, and climate. This results in contrasting hydrologic characteristics. Streamflow quality is best in the mountains where dissolved solids concentrations generally are least. These concentrations increase as streams flow through sedimentary basins. In the North Platte River, dissolved solids concentrations usually are less than 300 mg/L; in the Laramie and Medicine Bow Rivers, concentrations average 500 to 850 mg/L. Because of the semiarid climate of the basins, soils are not adequately leached. Consequently, flow in ephemeral streams usually has a larger concentration of dissolved solids than that in perennial streams, averaging 1,000 to 1,600 mg/L. Aquifers containing usable water are consolidated and unconsolidated Quaternary and upper Tertiary deposits; Mesozoic and Paleozoic sedimentary rocks; and lower Tertiary and Upper Cretaceous sedimentary rocks containing coal. These aquifers are used for municipal, domestic, irrigation, and stock supplies. Well yields range from about 5 to 1,000 gal/min and depend on type of aquifer, saturated thickness, and degree of fracturing. The best quality groundwater generally comes from aquifers that do not contain coal. Hydrologic problems related to surface mining are erosion and sedimentation, decline in water levels, disruption of aquifers, and degradation of water quality. General lack of runoff from semiarid mine areas combined with buffer and dilution capacities of major streams minimizes effects on surface water. However, effects on groundwater systems may be much more severe and longlasting. (USGS)
W88-03452

ASSESSMENT OF NONPOINT-SOURCE NUTRIENT DISCHARGES FROM THE SWITZER CREEK BASIN, STEUBEN COUNTY, NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
D. A. Sherwood.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 83-4278, 1984. 24 p, 10 fig, 7 tab, 14 ref.

Descriptors: *Nonpoint pollution sources, *Nutrients, *Water pollution sources, *New York, Nitrogen, Phosphorus, Organic carbon, Sediment yield, Streamflow, Land use, Agriculture, Nutrient loads, Atmospheric contributions, Switzer Creek, Steuben County.

Switzer Creek, tributary to the upper Susquehanna River basin, drains a 3.55 sq mi watershed that is 51% agricultural and 49% forested. From November 1978 to September 1980, Switzer Creek discharged 1,000 tons of suspended sediment, or 0.44 tons/acre. The maximum instantaneous suspended sediment concentration of 3,840 mg/L occurred during high water on September 14, 1979. Nitrogen loads, composed of nitrite plus nitrate total kjeldahl nitrogen, totaled 11 and 3.5 pounds/acre, respectively. Eighty percent of the total nitrogen load was transported during base flow. Of the nitrogen load transported during base flow, 88% was nitrite plus nitrate; of the total nitrogen load transported during high flows, 85% was organic nitrogen. Nearly 90% of the phosphorus load was transported during high flows as a result of its affinity for particulate matter. The load of total phosphorus as P totaled 0.63 pounds/acre, and total orthophosphorus as P totaled 0.19 pounds/acre. Nitrite plus nitrate from atmospheric sources totaled 8.4 pounds/acre, and ammonium totaled 3.9 pounds/acre. Equations relate streamflow to concentration and load of eight selected nutrients. (USGS)
W88-03454

GROUND-WATER FLOW IN THE PRAIRIE DU CHIEN-JORDAN AQUIFER RELATED TO CONTAMINATION BY COAL-TAR DERIVATIVES, ST. LOUIS PARK, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
J. R. Stark, and M. F. Hult.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4087, 1985. 57 p, 26 fig, 10 tab, 25 ref.

Descriptors: *Groundwater, *Hydrologic models, *Water pollution, *Groundwater movement, *Path of pollutants, *Minnesota, Finite difference models, Twin Cities metropolitan area.

A Three-dimensional, finite-difference, groundwater flow model of the Prairie du Chien-Jordan aquifer was developed to assess the movement of coal-tar derivatives from a coal-tar distillation and wood-preserving plant in St. Louis Park, Minnesota. The model was calibrated for steady-state and transient conditions. Sensitivity testing indicated that leakage to the upper model layer and the vertical hydraulic conductivity of the basal confining unit of the St. Peter were the most sensitive model hydrologic properties. Model simulations indicated that water introduced into the aquifer through wells open to several aquifers would raise the potentiometric surface of the Prairie du Chien-Jordan by as much as 3 ft in the area of the former plant. Other simulations suggested that withdrawal from certain upgradient wells may have altered local hydraulic gradients. These factors contributed to the potential for movement of contaminants from the area of the former plant to wells. Simulations of a proposed gradient-control plan indicate that the actions would be effective in limiting the expansion of the contaminated volume. These simulations also show, however, that control of discharge from all wells in the area will be important to the overall effectiveness of the plan. (USGS)
W88-03455

HYDROGEOLOGIC AND WATER-QUALITY CHARACTERISTICS OF THE ST. PETER AQUIFER, SOUTHEASTERN MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03456

SEISMIC REFRACTION STUDY OF SUSPECTED DRIFT-FILLED BEDROCK VALLEYS IN RAMSEY COUNTY, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03457

GEOHYDROLOGY OF ROCKS PENETRATED BY THE TEST WELL USW H-4, YUCCA MOUNTAIN, NYE COUNTY, NEVADA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03458

DESCRIPTION OF AQUIFER UNITS IN EASTERN OREGON,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03459

WATER QUALITY OF THE NORTH PLATTE RIVER, EAST-CENTRAL WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
L. R. Larson.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4172, 1985. 85 p, 44 fig, 7 tab, 12 ref.

Descriptors: *Chemical composition, *Dissolved solids, *Trace metals, *Water quality, *Water sampling, *Wyoming, Hydrologic data, Streamflow, Water quality standards, Reservoirs, North Platte River, Water quality assessment, Water-quality stations, Alcova Reservoir, Energy development.

This report is a statistical summary of 40 different constituents and physical characteristics that describe the water quality of the North Platter River between Alcova Dam and Orin, Wyoming, a distance of 143 river miles. Data from seven stations are summarized for 1970-79. Water entering the North Platte River upstream from Casper generally is more mineralized and degraded than the water in the North Platte River or in the tributaries entering the river downstream from Casper. The average dissolved solids concentration was about 320 mg/L at the upper sampling station and about 430 mg/L just downstream from Casper. This increase is typical of many other constituents. The mean fecal-coliform concentration at the upper station was about 8 colonies/ml and about 4,000 colonies/100 ml at the station downstream from Casper. Concentrations of some constituents periodically were greater than maximum recommended for drinking water supplies. About 24% of the dissolved solids concentrations were more than 500 mg/L. Some selenium concentrations exceeded the limit of 10 micrograms/L mandated for public water supplies. Large concentrations of copper, zinc, and ammonia indicate that these constituents might be a problem for sensitive aquatic life. (USGS)
W88-03462

HYDROLOGY OF FRITCHIE MARSH IN COASTAL LOUISIANA AND APPLICATION OF FINITE-ELEMENT MODELING TO DETERMINE FLOW,
Geological Survey, Baton Rouge, LA. Water Resources Div.
E. L. Kuniansky.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4324, 1985. 23 p, 10 fig, 2 tab, 13 ref.

Descriptors: *Marshes, *Tidal marshes, *Coastal marshes, *Salt marshes, *Model study, *Louisiana, Mixing, Finite element method, Coastal wetlands.

Fritchie Marsh, near Slidell, Louisiana, is being considered as a disposal site for sewage effluent. A two-dimensional, finite element, surface water modeling systems was used to solve the shallow water equations for flow. Factors affecting flow patterns are channel locations, inlets, outlets, islands, marsh vegetation, marsh geometry, stage of the West Pearl River, flooding over the lower Pearl River basin, gravity tides, wind-induced currents, and sewage discharge to the marsh. Four steady-state simulations were performed for two hydrologic events at two rates of sewage discharge. The events, near tide with no wind or rain and neap tide with a tide differential across the marsh, were selected as worst-case events for sewage effluent dispersion and were assumed as steady state events. Because inflows and outflows

to the marsh are tidally affected, steady state simulations cannot fully define the hydraulic characteristics of the marsh for all hydrologic events. Model results and field data indicate that, during near tide with little or no rain, large parts of the marsh are stagnant; and sewage effluent, at existing and projected flows, has minimal effect on marsh flows. (USGS)
W88-03465

WATER-QUALITY ASSESSMENT AND WASTEWATER-MANAGEMENT ALTERNATIVES FOR DARDENNE CREEK IN ST. CHARLES COUNTY, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
For primary bibliographic entry see Field 5G.
W88-03467

RECONNAISSANCE OF SELECTED ORGANIC CONTAMINANTS IN EFFLUENT AND GROUND-WATER AT FIFTEEN MUNICIPAL WASTEWATER TREATMENT PLANTS IN FLORIDA, 1983-84,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. B. Pruitt, D. E. Troutman, and G. A. Irwin.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4167, 1985. 29 p, 7 fig, 5 tab, 13 ref.

Descriptors: *Water pollution sources, *Path of pollutants, *Organic compounds, *Groundwater contamination, *Florida, Wastewater facilities, Effluent seepage.

Results of a 1983-84 reconnaissance of 15 municipal wastewater treatment plants in Florida indicated that effluent from most of the plants contains trace concentrations of volatile organic compounds. Chloroform was detected in the effluent at 11 of the 15 plants and its common occurrence was likely the result of chlorination. The maximum concentration of chloroform detected in the effluent sampled was 120 micrograms/L. Detectable concentrations of selected organophosphorus insecticides were also common. For example, diazinon was detected in the effluent at 12 of the 15 plants with a maximum concentration of 1.5 micrograms/L. Organochlorinde insecticides, primarily lindane, were detected in the effluent at 8 of the 15 plants with a maximum concentration of 1.0 micrograms/L. Volatile compounds, primarily chloroform, were detected in water from monitor wells at four plants and organophosphorus insecticides, primarily diazinon, were present in the groundwater at three treatment plants. Organochlorinde insecticides were not detected in any samples from monitor wells. Based on the limited data available, this cursory reconnaissance suggests that the organic contaminants commonly occurring in the effluent of many of the treatment plants are not transported into the local groundwater. (USGS)
W88-03469

ASSESSMENT OF CHEMICAL AND BIOLOGICAL SIGNIFICANCE OF ARSENICAL COMPOUNDS IN THE MAURICE RIVER DRAINAGE BASIN (N.J.). PART III. TRANSFORMATIONS IN AEROBIC AND ANAEROBIC CONDITIONS,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
S. D. Faust, A. J. Winka, and T. Belton.
Journal of Environmental Science and Health JESEDU, Vol. 22, No. 3, p 263-282, April 1987. 4 fig, 6 tab, 15 ref. N.J. Department of Environmental Protection Grant 4810-100-187030.

Descriptors: *Reservoirs, *Path of pollutants, *Arsenic, *Maurice River basin, *Water pollution effects, *Sediments, Pollutant identification, Rivers, Distribution, Arsenic compounds, New Jersey, Temperature, Aerobic conditions, Anaerobic conditions.

A quiescent reservoir system revealed the effects of temperature (20 C and 30 C), oxygen levels (aerobic and anaerobic) on the arsenic partitioning and interconversion in organic and sandy lake sediments. Temperature had little or no effect on the specie partitioning. In aerobic reservoirs (sandy and organic), the As(V) levels increased, especially in the organic sediment. In the anaerobic reservoir, the organic sediment maintained its level of As(III). The sandy sediment has a predominance of As(V) suggesting something other than the level of oxygen is a significant controlling factor. (Author's abstract)
W88-03477

EFFECTS OF PH AND FEEDING REGIME ON METHYLMERCURY ACCUMULATION WITHIN AQUATIC MICROCOSMS,
Ontario Hydro, Toronto.
D. W. Rodgers, T. A. Watson, J. S. Langan, and T. J. Wheaton.
Environmental Pollution EPEBD7, Vol. 45, No. 4, p 261-274, 1987. 3 fig, 1 tab, 41 ref. Ontario Ministry of Environment Contract Project 78-022-11, Order A57823.

Descriptors: *Path of pollutants, *Water pollution effects, *Mercury, *Bioaccumulation, *Methylmercury, *Isotope studies, Food chains, Daphnia, Fish, Predation, Diets.

The effect of pH (pH 5, 6 or 7) on accumulation of radiolabelled methylmercury was examined using a laboratory microcosm system. Accumulation of labelled mercury at three trophic levels, primary consumers (Daphnia magna), secondary consumers (rainbow trout, Salmo gairdneri) and tertiary consumers (walleye, Stizostedion vitreum) was not significantly affected by pH. The results are in direct contrast with field observations of elevated methylmercury concentrations in fish from low pH water and indicate that the elevated mercury residues observed in the field result from factors other than the direct effects of pH on accumulation of methylmercury by aquatic organisms. Both water and diet were important as sources of the labelled mercury which was accumulated by walleye. Walleye which were fed rainbow trout, that had accumulated labelled mercury from within the experimental microcosms, accumulated almost twice as much labelled mercury as walleye fed non-labelled prey, or walleye which were not fed. Walleye fed non-labelled rainbow trout accumulated slightly more labelled mercury than walleye which were not fed, presumably as a result of the higher metabolic rate of the fish which were fed. (Author's abstract)
W88-03480

FATE OF METAL CONTAMINATED SEDIMENTS IN FOUNDRY COVE, NEW YORK,
State Univ. of New York at Stony Brook. Dept. of Ecology and Evolution.
A. B. Knutson, P. L. Klerks, and J. S. Levinton.
Environmental Pollution EPEBD7, Vol. 45, No. 4, p 291-304, 1987. 5 fig, 3 tab, 11 ref.

Descriptors: *Fate of pollutants, *Path of pollutants, *Heavy metals, *Sediments, *Foundry Cove, Hudson River, Industrial wastewater, Surveys, Cadmium, Nickel, Cobalt.

The distribution of heavy metal contaminated sediments in Foundry Cove, a freshwater embayment of the Hudson River, was examined twelve years after the discharging of wastes from a battery factory had ceased. Concentrations of Cd, Ni and Co were measured in surficial sediments (top 5 cm) and seven detailed depth profiles. Comparison with earlier surveys showed that metal levels of surficial sediments have been considerably reduced throughout the cove. Evidence suggests that this reduction may be largely due to burial rather than transport of metals out of the cove or a redistribution (via sediment resuspension and redeposition) within the cove. This is suggested by the presence of a peak in metal concentrations at a depth of several centimeters in depositional environments, a calculation showing the loss of waterborne cadmium to be much less than the amount of cadmium lost from the surficial sediment, and the absence of increased pollution in the cleaner parts of the cove. Despite improvement, metal levels remain extremely high, including a persistent 'hot-spot' with levels higher than 10000 ppm Cd. (Author's abstract)
W88-03482

POTENTIAL FOR MIGRATION OF HAZARDOUS WOOD TREATING CHEMICALS DURING LAND TREATMENT OPERATIONS,
Mississippi State Univ., Mississippi State. Forest Products Utilization Lab.
G. D. McGinnis.
Available from the National Technical Information Service, Springfield, VA 22161, as PB87-159448/AS. Price codes: A04 in paper copy, A01 in microfiche. Mississippi Water Resources Research Institute, Mississippi State. Technical Interim Report G1026-03, July 1986. 53 p, 10 tab, 3 append. Contract No. 14-08-0001-G1026. Project No. USGS G1026-03.

Descriptors: *Land disposal, *Hazardous wastes, *Path of pollutants, *Fate of pollutants, Migration, Groundwater pollution, Microbial degradation, Biodegradation.

The amounts and types of toxic chemicals that migrate into the groundwater during active land treatment operations were studied to determine the relative rates of migration versus biological degradation using three types of soil found in the southeastern United States, to identify and quantify the breakdown products from active land-farming operations, and to determine the toxicity of the water-soluble products formed during active land treatment processes. The project is a two-year project and is approximately 50% complete. All the sites used for this study have been characterized. The hazardous waste at each site has been characterized chemically using a variety of parameters. The rates of microbiological degradation and the migration studies are now in progress and should be complete later this year. (McGinnis-Mississippi State University)
W88-03484

CHEMISTRY AND APPARENT QUALITY OF SURFACE WATER AND GROUND-WATER ASSOCIATED WITH COAL BASINS,
Arkansas Univ., Fayetteville. Water Resources Research Center.
For primary bibliographic entry see Field 2K.
W88-03486

ANALYSES OF GROUNDWATER FOR TRACE LEVELS OF PESTICIDES,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
For primary bibliographic entry see Field 5A.
W88-03489

BEHAVIOR OF SOLUBLE SALT SHARKEY CLAY,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
J. T. Gilmour, J. A. Ferguson, H. D. Scott, and R. E. Baser.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-153657/AS. Price codes: A03 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville. Publication No. 117, 26 p, 6 fig, 5 tab. September 1985. Contract No. 14-08-0001-G893. Project No. USGS G893-03.

Descriptors: *Soil salinity, *Rice irrigation, *Arkansas, Irrigation water, Infiltration.

Soluble salt problems do exist and are significant in Arkansas. Studies have been conducted on Crowley silt loam (Typic Albaqualfs) which have established the behavior of soluble salt in that soil. The major objective of this study was to quantify the behavior of soluble salt in a second important Mississippi River Delta soil - Sharkey (Vertic Haplaquepts). To this end, estimation of the downward redistribution of salt and the estimation of various components of the water balance for this soil served as specific objectives. Field studies were designed to monitor the movement of salt in the Sharkey soil and to characterize selected components of the water balance. In total, three tentative conclusions may be drawn from the data. First, the infiltration for the Sharkey soil was ap-

proximately three times that of the Crowley silt loam. The average value was 29 cm for the rice season. Second, levee seepage, while significant for small plots, was shown to be small for production sized fields. Levee seepage remained relatively constant throughout the season and averaged 0.025 cu m/m/d. And third, downward redistribution of salt was large and appeared to follow a pattern where a peak occurred at the surface and, possibly, at the lower soil depths. (Gilmour-WRRC-University of Arkansas, Fayetteville)
W88-03491

MATHEMATICAL MODELING OF SEDIMENTATION EFFECTS ON WATER RESOURCES SYSTEMS,
Mississippi State Univ., Mississippi State. Center for Computational Hydroscience and Engineering.
For primary bibliographic entry see Field 2J.
W88-03492

5C. Effects Of Pollution

RESPONSE OF LIMED LAKES TO EPISODIC ACID EVENTS IN SOUTHWESTERN SWEDEN,
Swedish Environmental Research Inst., Goeteborg.
B. Hasselrot, I. B. Andersson, I. Alenas, and H. Hultberg.
Water, Air, and Soil Pollution WAPLAC, Vol. 32, No. 3/4, p 341-362, February 1987. 11 fig, 6 tab, 42 ref.

Descriptors: *Water pollution effects, *Lakes, *Limnology, *Acid events, *Acid rain, Snow melt, Rainfall, Stratification, Water chemistry, Acidity, Liming.

Occurrence of stratified acidic water is described for five forest lakes situated in the west coast region of Sweden. Differentiation between two types of acid events is made related to origin; one is caused by heavy rains and the other associated with snowmelt during winter and spring. Acid events are due to incomplete mixing between lake and inflow water. Both mixing forces like wind and density differences are important factors regulating the actual stratification. As observed in the lakes studied, stratification therefore occurs during periods of ice-cover when wind-induced mixing is impeded and generally results in an acidic surface water of varying depth. However, in this study the stratification of acid inflow water at the sediment-water interface is also described. This type of inlayering is presumably less frequent as a complex set of conditions must be satisfied for its occurrence. The study shows that acid events may cause temporal and spatial water chemistry changes even in lakes and streams with relatively high pH and buffer capacity. Thus, early biotic damages can be expected in neutral and limed (soft water) lakes. (Author's abstract)
W88-02498

PREVENTIVE EFFECTS OF AMINO ACIDS ON THE TOXICITY OF COPPER TO DAPHNIA MAGNA,
Western Energy, Inc., Palo Alto, CA.
B. S. Khangarot, P. K. Ray, and H. Chandra.
Water, Air, and Soil Pollution WAPLAC, Vol. 32, No. 3/4, p 379-387, February 1987. 4 tab, 22 ref.

Descriptors: *Water pollution effects, *Amino acids, *Toxicity, *Copper, *Daphnia, Survival, Population exposure, Mortality, Heavy metals.

The protective role of 18 amino acids on the acute toxicity of Cu in a fresh water cladoceran, Daphnia magna is reported. One hundred percent mortality in 48 hr of exposure occurred at 0.56 mg/L of Cu or higher. A dose of each tested amino acid (10 mg/L) was found to significantly neutralize the toxic effect of Cu as evidenced by a decrease in mortality and a significant increase in the median survival time (LT50) value). The 48 hr LC50 value was 0.093 mg/L for Cu alone, while the LC50s with Cu plus amino acids ranged from 0.438 to 2.516 mg/L of Cu, suggesting a 4.7 to 27 fold decrease in acute toxicity of Cu. A significant difference between LC50 of Cu alone and Cu with amino acids was observed. The role of amino acids for protection against heavy metal pollution stress in aquatic animals is discussed. (Author's abstract)
W88-02499

EFFECTS OF RECENT ENVIRONMENTAL CHANGES IN LAKE WAAHI ON TWO FORMS OF THE COMMON SMELT RETROPINNA RETROPINNA, AND OTHER BIOTA,
Manitoba Univ., Winnipeg. Dept. of Zoology.
F. J. Ward, T. G. Northcote, and M. A. Chapman.
Water, Air, and Soil Pollution WAPLAC, Vol. 32, No. 3/4, p 427-443, February 1987. 6 fig, 3 tab, 22 ref.

Descriptors: *Water pollution effects, *Lakes, *Limnology, *Smelt, *Mine wastes, *Phenols, *Turbidity, Species diversity, Aquatic animals, Fish, Sediments, Silts.

Since 1977 open cast (open pit) coal mining has increased discharge of silt-laden wastes into Lake Waahi, a small shallow lake in the Waikato River system, New Zealand. Phenolic wastes from a coal carbonization factory on the major tributary also have entered the lake in high but variable concentrations since 1974. During and after the summer of 1978-1979 total suspended solids and turbidity were high, the formerly dense macrophyte beds disappeared, the summer phytoplankton community changed from dominance by blue-green algae to diatoms, the eel fishery failed and the black swan population decreased to low levels. The once abundant lake resident form of the common smelt declined drastically between 1975 and 1981 and apparently was extinct by 1983. The migratory form, although abundant until 1981, was scarce by 1983. Low water levels in the outlet stream and the malfunction of a fish pass in the flood control structure located near its mouth may have impeded upstream migration in the spring of 1982. The major cause for the changes in lake Waahi was the addition of silt; however, the loss of macrophytes may have caused increased toxicity of phenols, particularly to eels, and also promoted continual resuspension of sediments by more effective wind-produced circulation. Remedial measures are considered. (Author's abstract)
W88-02502

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUBSTANCES.
Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. 279 p. Edited by Thomas R. Patin.

Descriptors: *Sediments, *Water pollution effects, *Conferences, *Waste disposal, *Dredging, *Sediment disposal, Information exchange, Toxicity, Estuaries, Lakes, Rivers.

The 11th U.S./Japan Experts Meeting on Management of Bottom Sediments Containing Toxic Substances was held 4-6 November 1985 in Seattle, Washington. The meeting is held annually through an agreement with the U.S. Army Corps of Engineers and the Japan Ministry of Transport to provide a forum for presentation of papers and in-depth discussions on dredging and disposal of contaminated sediment. Experts from both countries presented technical papers on a variety of subjects including legal and research programs to evaluate and protect the environment. More specifically, evaluating and predicting the behavior of nutrients, organics, and contaminants in dredged sediments and identifying and evaluating the many alternatives to dredging and disposal of contaminated sediments from: lakes, rivers, waterways, estuaries, and marine waters associated with these sediments. Management practices with the most promising long-term utility were emphasized. (See W88-02514 thru W88-02532) (Lantz-PTT)
W88-02513

COMMENCEMENT BAY - A REMEDIAL INVESTIGATION OF CONTAMINATED SEDIMENTS IN A MARINE ENVIRONMENT,
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 5B.
W88-02517

TEST RESULTS OF SEDIMENT REMOVAL IN ISE BAY,
Port Construction Bureau, Nagayo (Japan). 5th District.
For primary bibliographic entry see Field 5G.
W88-02519

EFFECTS OF SEDIMENT REMOVAL IN TOKYO BAY,
Port Construction Bureau, Yokohama (Japan). 2nd District.
T. Sato, S. Kojima, and H. Mori.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 136-148, 17 fig.

Descriptors: *Environmental effects, *Sediment removal, *Tokyo Bay, Organic matter, *Water pollution effects, *Dredging, Nutrients, Suspended sediments, Chemical oxygen demand, Phosphates, Nitrogen.

Although the removal of organic sediment is conceptually understood as an effective countermeasure against environmental pollution, few data exist concerning the extended removal effects of sediment. To study this problem, the Second District Port Construction Bureau of the Ministry of Transport conducted several surveys on organic sediment of Tokyo Bay to observe dredging effects in 1982-1984. Nutrient concentrations in sediment increase gradually with time after sediment removal under the influence of foreign material such as newly precipitating matter or suspended sediment. This gives the impression that no restorative effects can be expected from sediment removal. However, it should be studied from the viewpoint of release rates. This study indicates that release rates increase with time as the foreign material accumulates, and result in an early increase of release rates, thereby cancelling the removal effects. It is believed that a decrease in release rates in the early stages may result from diffusion into the underlying sediment because the underlying sediment is clean due to removal of the polluted material. Diffusion into the underlying sediment continues until both the concentrations of release material from foreign materials and in sediment pore water become equal. After that, the release rates increase again. The relationship between dredging depth and release rate of COD, PO4-P, and T-N released from the bed for 1 year after the dredging, is illustrated. Both cases (with and without cap) show that the release rates decrease with increasing thickness of the sediment removal. (See also W88-02513) (Lantz-PTT)
W88-02521

EFFECTS OF SEDIMENT ON THE SURVIVAL OF MYSIDS EXPOSED TO ORGANOTINS,
Naval Ocean Systems Center, San Diego, CA. Environmental Sciences Div.
M. H. Salazar, and S. M. Salazar.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 176-192, 4 fig, 5 tab, 25 ref.

Descriptors: *Water pollution effects, *Heavy metals, *Bioassay, *Mysides, *Organotins, Toxicity, Lethal limits, Acanthomycis sculpta, Contaminated sediments, Tributyltin, Statistical analysis, Environmental effects, Sediments.

A 10-day flow-through toxicity test was conducted by exposing mysids (Acanthomysis sculpta) to organotin antifouling (AF) leachates. A paired design with and without sediment was used to determine if sediment affects the survival of mysids exposed to organotin AF leachates. Since the Navy is considering a fleetwide conversion from copper-based AF coatings, it is studying the potential environmental impact of organotins and their effect on the dredging permit process. Eighteen-day-old mysids were exposed to tributyltin (TBT) concentrations

averaging 0.60 ppb for 10 days in the presence and absence of sediment. TBT concentrations in tanks with and without sediment ranged from 0.41 to 0.80 ppb and 0.54 to 0.78 ppb, respectively. Sediment did not accumulate detectable quantities of TBT during 31 days of exposure. Sediment and toxicant both affect the survival of mysids by day 7 and continued to be a factor until the end of the experiment. Mysids exposed to TBT exhibited significantly higher survival in tanks with sediment than in tanks without sediment. A significant decline in survival in the TBT tanks without sediment was observed 2 days before such a decline in the TBT tanks with sediment. The TBT toxicant became a significant deleterious factor by day 8. After 10 days control survival was 100% with sediment and 95% without sediment; TBT treatment survival was 46% with sediment and 30% without sediment. (See also W88-02513) (Author's abstract)
W88-02525

FOOD CHAIN STUDIES AT TIMES BEACH CONFINED DREDGED MATERIAL DISPOSAL SITE, BUFFALO, NEW YORK,
Army Engineer District, Buffalo, NY.
R. P. Leonard.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 193-212, 4 fig, 13 tab, 3 ref.

Descriptors: *Food chains, *Times Beach, *New York, *Disposal sites, *Waste disposal, *Buffalo, *Polychlorinated biphenyls, *Dredging, Waterfowl, Ecological effects, Fish, Insects, Aromatic hydrocarbons, Path of pollutants, Rhizomes, Cattails, Cadmium, Heavy metals, Mammals.

The 46-acre Times Beach Confined Disposal Facility (CDF) Buffalo, New York, was half filled with polluted dredged material between 1972 and 1976. Filling was stopped at the request of environmental groups because of the large numbers of migratory waterfowl and birds which occupied the area. In the intervening years, open water, wetland, and wooded upland zones have evolved with associated wildlife and vegetation. At the present time, wetland and aquatic plant communities, earthworms, fish, insects, and toads have been sampled from the disposal area and analyzed for heavy metals, polychlorinated biphenyls (PCBs), and polyaromatic hydrocarbons (PAHs). Results of these samplings and analyses are reported in this paper. The data showed less accumulation of metals in plant seeds than in leaves or rhizomes. Cattail rhizomes were high accumulators of heavy metals, especially cadmium and arsenic. Aquatic plants accumulated greater concentrations of metals than wetland plants. Very low concentrations of organic contaminants were found in plant samples. Accumulation of metals in earthworms at Times Beach was much higher than accumulation in earthworms from a natural reference area. Cadmium levels in earthworms were elevated. In general, metal levels in insects and toads from dredged material and a contiguous background location were comparable. Cadmium appeared to be higher in insects from the dredged material. Concentrations of heavy metals in fish indicated that mercury was more elevated in fish from the Times Beach site compared with a reference site at the mouth of the Buffalo River. PCBs and PAHs were also more elevated in fish from the Times Beach CDF. Mammal, fish, and bird populations have been inventoried at the Times Beach CDF. Future study will be directed at sampling and analyzing key higher food chain species at the Times Beach for contaminant bioaccumulation and effects. (See also W88-02513) (Author's abstract)
W88-02526

EFFECTS OF DISCHARGING A PRIMARY SEWAGE EFFLUENT ON THE TRIASSIC SANDSTONE AQUIFER AT A SITE IN THE ENGLISH WEST MIDLANDS,
Water Research Centre, Medmenham (England). Medmenham Lab.
For primary bibliographic entry see Field 5B.
W88-02541

ACID RAIN: PROBLEM DEFINITION,
State Univ. of New York at Albany. Atmospheric Sciences Research Center.
V. A. Mohnen.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 14-26, 16 fig, 1 tab, 7 ref.

Descriptors: *Acid rain, *Water pollution effects, *Path of pollutants, Environmental effects, Lakes, Water quality, Hydrogen ion concentration, Acidic water, Sulfates, Sulfur dioxide, Nitrates, Water pollution control.

Acid rain occurs at many places in North America, but exhibits significant maxima in the northeastern United States and adjacent Canadian provinces. pH contour maps and the precipitation-weighted concentration of sulfate and nitrate ions derived from the NADP and CANSAP networks from 1979 through teh end of 1981 are illustrated. Based on bedrock geology, there are large regions in North America containing lakes that are potentially sensitive to acidification by acid precipitation: lakes located within such sensitive areas and with clearly demonstrated 'damages'; and lakes within sensitive regions, but in which no 'damage' was found. The main difference between these two aquatic systems sensitive to acidic deposition is that (1) one set of lakes received preciptation with pH levels well below 4.6, while (2) the precipitation acidity received by the other lakes was well above the 4.6 level. Regional models have been developed - and have been operated as part of the US-Canadian joint efforts organized under the 1980 Memorandum of Intent between the two countries - in an attempt to establish source/receptor relationships between acidic deposition precursors and wet and dry deposition. Two distinct types of models are in use today for studying long-range transport of air pollutants: Eulerian grid models and Lagrangian trajectory models. Observations pertinent to the 'acid rain problem' in the northeastern US are: (1) The order of importance of acidifying processes for the Adirondacks and the unmanaged land of New England and the northeastern Canadian region; (2) The chemical climate of the atmosphere in the northeastern US seems to have significantly improved - or at least not further deteriorated - over the past two and one-half decades or so; and (3) Water quality records collected over a 10-year to 15-year period from the USGS Hydrologic Benchmark Network (a nationwide network of sampling stations in predominantly undeveloped stream basins), show small declines in stream sulfate at stations in the northeastern quarter of the US Stream sulfate concentrations at most benchmark stations are low enough to be significantly influenced by changes in the rate of atmospheric deposition of sulfur. (See also W88-02650) (Lantz-PTT)
W88-02651

SCIENTIFIC ISSUES ASSOCIATED WITH ACID RAIN,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
C. Riordan.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 76-81.

Descriptors: *Acid rain, *Environmental effects, *Water pollution effects, Acidic water, Lakes, Watersheds, Water quality.

Recently an issue has been emerging from the scientific and academic community, regarding acid rain. It involves two different hypotheses about how the acidification process works. For the purpose of this discussion one is called the 'delayed-response' hypothesis, and the other the 'direct-response' hypothesis. The delayed-reponse hypothesis is the one most commonly accepted among the general public who have learned about acid deposition. This hypothesis holds that the acidification of lakes is a long-term process, that acid deposition accumulates over a number of years, and that after it uses up the neutralizing capacity in the watershed, more and more acidity will flow into a lake and it may become acidic. The implication of this hypothesis is that unless deposition is decreased, we will continue to see more and more lakes become acidic. The direct-response hypothesis is suggested as specifically applicable to some or a large proportion of the Northeast. It holds that the acidification of lakes is more immediate than long term. Under this hypothesis, the sensitivityy of a watershed depends on the rate at which it can make buffering materials available to neutralize acidity, not on the extent of stored-up capacity for buffering. Therefore, the equilibrium between what's coming down in deposition and what's going into the lake is established very quickly in 10 years or less. If this hypothesis were proved to be true for most or all watersheds in the Northeast, it would imply that if the deposition does not increase, the lakes and streams which are acidified today would be the lakes and streams which would be acidified may years from now. As fascinating as these hypotheses are, there are not sufficient empirical data to determine which of them is correct and for what watersheds. The reserach efforst by the Federal government and others are continually yielding results that add to our knowledge and understanding of the problem. Progress isn't necessarily a function of scale or projects or level of funding. Small projects can yield large payoffs and vice versa. Current knowledge and understanding about the acid rain program has increased remarkably just over the last five years. That growth should continue at a rapid rate. (See also W88-02650) (Lantz-PTT)
W88-02658

GENETIC ADAPTATION TO HEAVY METALS IN AQUATIC ORGANISMS: A REVIEW,
State Univ. of New York at Stony Brook. Dept. of Ecology and Evolution.
P. L. Klerks, and J. S. Weis.
Environmental Pollution ENVRAL, Vol. 45, No. 3, p 173-205, 1987. 38 fig, 4 tab, 49 ref. NSF Grants ATM-8109590 and ATM-8407543.

Descriptors: *Water pollution effects, *Population exposure, *Heavy metals, *Aquatic life, *Reviews, *Adaptation, Toxicity, Pollutants, Metals, Evolution, Survival.

Natural populations in polluted areas are possibly subjected to selective pressures for an increased resistance to toxicants. This can result in the evolution of resistance, which may have important implications for decisions regarding safe ambient toxicant levels. By reviewing the evolution of resistance to heavy metals in aquatic organisms, the study aimed to determine if all populations negatively affected by toxicants do adapt to them. If the published literature accurately represents the situation in polluted areas (i.e. negative results having an equal chance of being published), it can be concluded that most, but not all, populations in polluted areas do have an increased resistance. But it can usually not be determined if such an increased resistance has a genetic basis. There is less evidence for the evolution of resistance in metazoans (especially fish) than in micro-organisms. Additional information strongly indicates that many populations fail to survive in polluted environments. It thus seems dangerous to relax water quality criteria on the assumption that all populations in polluted environments will evolve an increased resistance. But the fact that the evolution of resistance to environmental pollutants does seem to occur in some populations in polluted environments warrants taking that possibility into consideration when evaluating the results of bioassays and monitoring programs. (Author's abstract)
W88-02691

BIOLOGICALLY BASED WATER QUALITY MANAGEMENT,
Anglian Water Authority, Lincoln (England). Lincoln Div.
C. A. Extence, A. J. Bates, W. J. Forbes, and P. J. Barham.
Environmental Pollution ENVRAL, Vol. 45, No. 3, p 221-236, 1987. 13 tab, 11 ref.

Descriptors: *Water pollution effects, *Water quality, *Streams, *Water pollution control, *Rivers, Pollutants, *Monitoring, Water pollution, Bioindicators.

A method of reporting water quality and assessing compliance with targets, based on the Biological Monitoring Working Party score system, is proposed. The use of the technique enables biologists to present operations managers, and other professionals, with quality data from any freshwater habitat in the form of a simple index. Results obtained can be compared with predefined targets based on river use, National Water Council class, or both. It may also be used to assess the degree of pollution in specific cases. The method is currently being used throughout the Anglian Water Authority region for small stream monitoring and, in some Divisions, for the presentation of all biological results. The technique has the potential to fully integrate biological monitoring into an operational role. (Author's abstract)
W88-02692

EFFECT OF ADAPTATION TO PHENOL ON BIODEGRADATION OF MONOSUBSTITUTED PHENOLS BY AQUATIC MICROBIAL COMMUNITIES,
Procter and Gamble Co., Cincinnati, OH. Ivorydale Technical Center.
R. J. Shimp, and F. K. Pfaender.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 7, p 1496-1499, July 1987. 1 fig, 2 tab, 23 ref. EPA Assistance Agreement CR-809235-02-4.

Descriptors: *Water pollution effects, *Fate of pollutants, *Phenols, *Adaptation, *Microorganisms, *Biodegradation, Organic compounds, Aromatic compounds.

The adaptation of a mixed aquatic microbial community to phenol was examined in microcosms receiving phenol as a sole carbon source. Extended exposure (adaptation) to phenol resulted in adaptation of the microbial community to the structurally related aromatic compounds m-cresol, m-aminophenol, and p-chlorophenol. The increased biodegradation potential of the phenol-adapted microbial community was accompanied by a concurrent increase in the number of microorganisms able to degrade the three test compounds. Thus, adaptation to the three test chemicals was likely a growth-related result of extended exposure to phenol. The results indicate that adaptation to a single chemical may increase the assimilative capacity of an aquatic environment for other related chemicals even in the absence of adaptation-inducing levels of those materials. (Author's abstract)
W88-02707

LONG-TERM SLUDGE APPLICATIONS ON CADMIUM AND ZINC ACCUMULATION IN SWISS CHARD AND RADISH,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5E.
W88-02717

NITROGEN MINERALIZATION IN SEWAGE-SLUDGE-AMENDED COAL MINE SPOIL AND TOPSOILS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 5E.
W88-02719

RESPONSE OF COTTON, ALFALFA, AND CANTALOUPE TO FOLIAR-DEPOSITED SALT IN AN ARID ENVIRONMENT,
Arizona Univ., Tucson. Dept. of Plant Sciences.
W. C. Hofmann, M. M. Karpiscak, and P. G. Bartels.
Journal of Environmental Quality JEVQAA, Vol. 16, No. 3, p 267-272, July-September 1987. 1 fig, 5 tab, 34 ref.

Descriptors: *Water pollution effects, *Salt tolerance, *Cotton, *Alfalfa, *Cantaloupes, *Arid climates, Cooling towers, Power plants, Salts, Agriculture, Crop yield, Plants.

The cooling towers at the Palo Verde Nuclear Generating Station (PVNGS), located 80 km west of Phoenix, AZ, will release an estimated 2.1 Mg/d of particulates (Primarily salts) into the atmosphere when the station is in full operation. The saline drift will disperse and settle onto agricultural fields surrounding the station. Field studies were conducted in 1983 to investigate the influence of foliar-applied saline aerosol on crop growth, foliar injury, and tissue elemental concentration on cotton (Gossyplum hirsutum L.), alfalfa (Medicago sativa L.), and cantaloupe (Cucumis melo L.) in an arid environment. The treatment aerosol solutions simulated treated wastewater effluent and included all essential plant nutrients and other elements, including trace concentrations of heavy metals. The treatments included unsprayed plots, and plots sprayed with salt solutions at 0 (distilled water), 8, 83, and 415 kg/(ha yr). The alfalfa received an additional 829 kg/(ha yr) treatment. The species were evaluated in separate experiments on Mohave clay loam and Sonoita sandy loam soils (Typic Haplargid) near Marana, AZ. Cotton treated at a rate of 829 kg/(ha yr) showed significantly more leaf margin necrosis than did the unsprayed alfalfa. In the cantaloupe, there were no visually apparent differences among salt treatments. Hand-harvested cotton plots had a significant reduction in seed cotton yield at the at the 415 kg/(ha yr) treatment ($P < or - 0.05$). A similar though nonsignificant, trend towards reduced yield with increased salt treatment was observed in machine-harvested cotton plots. No significant yield differences were detected in the alfalfa or cantaloupe. (Author's abstract)
W88-02721

REQUIREMENTS ON THE HANDLING OF CHEMICALS AND WASTES REGARDING SOIL AND GROUNDWATER PROTECTION,
Umweltbundesamt, Berlin (Germany, F.R.).
For primary bibliographic entry see Field 4C.
W88-02727

PROTEIN AND NUCLEIC ACID CONTENT IN DAPHNIA MAGNA DURING CHRONIC EXPOSURE TO CADMIUM,
Missouri Univ.-Columbia. Dept. of Entomology.
C. O. Knowles, and M. J. McKee.
Ecotoxicology and Environmental Safety EESADV, Vol. 13, No. 3, p 290-300, June 1987. 4 fig, 3 tab, 33 ref.

Descriptors: *Daphnia, *Cadmium, *Nucleic acids, *Water pollution effects, *Proteins, Population exposure, Reproduction, Growth, Heavy metals, Survival.

Daphnia magna Straus were exposed to cadmium concentrations of 0, 0.4, 0.8, 2.1, 4.3, and 7.2 microgram(ug)/L for 21 days. Protein, RNA, DNA, glycogen and lipid content were measured after 4, 7, and 21 days of exposure, and the results were related to survival and reproduction. The no observed effect concentration (NOEC) for survival, protein growth, and reproduction at Day 21 was 2.1, 0.8, and 0.8 ug/L cadmium, respectively. Protein growth was most sensitive to cadmium exposure following the rapid growth phase which occurred between Days 4 and 6 of growth and development. All concentrations of cadmium produced significant reductions in protein growth at Day 7 indicating that the NOEC was < 0.4 ug/L. RNA:protein and protein:RNA:DNA ratios, which are related to the growth rate of daphnids, were most appropriately monitored at Day 4 which was prior to the rapid growth phase. Protein:RNA:DNA ration at Day 4 identified the same NOEC as identified by protein growth and reproduction after 21 days of exposure. (Author's abstract)
W88-02728

EFFECT OF A VEGETABLE OIL FACTORY EFFLUENT ON IN VITRO LIPID AND PROTEIN SYNTHESIS BY THE LIVER OF THE FRESHWATER TELEOST HETEROPNEUSTES FOSSILIS (BLOCH),
Punjab Agricultural Univ., Ludhiana (India). Dept. of Zoology.
J. K. Kondal, P. K. Saxena, and G. L. Soni.
Environmental Research ENVRAL, Vol. 43, No. 1, p 13-18, June 1987. 4 tab, 18 ref.

Descriptors: *Industrial wastewater, *Effluents, *Lipids, *Food-processing wastes, *Isotope studies, *Water pollution effects, *Proteins, Population exposure, Reproduction, Waste disposal, Growth.

Following exposure to three sublethal concentrations (5, 10, and 15% v/v) of vegetable oil factory effluent for 30 days (March 1 through March 30, 1984), during the preparatory phase of the annual reproductive cycle of Heteropneustes fossilis, the in vitro incorporation, of (14C)glucose/(14C)acetate into the lipids and of (14C)leucine into the proteins by the liver declined when compared with the control. In the three concentrations of the effluent used, the decline in the incorporation of radiolabelled substances increased with increase in the concentration. (Author's abstract)
W88-02729

EFFECT OF SUGAR MILL EFFLUENT ON OXYGEN UPTAKE AND CARBON DIOXIDE OUTPUT OF RICE (ORYZA SATIVA L.C.V. MUSHOORI) SEEDLINGS,
Maharshi Dayanand Univ., Rohtak (India). Dept. of Biosciences.
B. K. Behera, and S. A. Sayeed.
Environmental Research ENVRAL, Vol. 43, No. 1, p 135-141, June 1987. 3 fig, 26 ref.

Descriptors: *Water pollution effects, *Waste disposal, *Industrial wastewater, *Water reuse, *Food-processing wastes, *Wastewater disposal, *Rice, *Effluents, Respiration, Oxygen, Carbon dioxide, Seedlings, Plants.

The effects of a sugar mill effluent on respiration of rice (Oryza sativa L.c.v. Mushoori) seedlings have been investigated. Each experiment consisted of two parts, (i) the effect of various concentrations of the effluent and (ii) the time-dependent changes induced by the undiluted effluent. A marked increase in the rate of respiration was noticed upon treatment with various concentrations of the effluent. The time-dependent changes in the respiratory rate were about threefold with the 12 hr of treatment, and thereafter a rapid loss was noticed. Additionally, the respiratory quotient was studied to elucidate the nature of the metabolism of seedlings as influenced by the effluent. (Author's abstract)
W88-02730

ECOTOXICITY OF COPPER TO AQUATIC BIOTA: A REVIEW,
University of Science, Penang (Malaysia). School of Biological Sciences.
Y. M. Nor.
Environmental Research ENVRAL, Vol. 43, No. 1, p 274-282, June 1987. 3 tab, 46 ref.

Descriptors: *Water pollution effects, *Ecotoxicity, *Copper, *Aquatic life, *Reviews, Heavy metals, Ions, Toxicity, Complexes.

The toxic effects of copper on numerous aquatic flora and fauna have been studied intensely over the past 10 years. In general, there is a consensus that free cupric ions are more toxic if compared with other chemical forms such as organically complexed copper. Biological indicators exhibit a tremendously wide range of sensitivity to copper with toxic effects noted at pCu as low as 10 for some algae, while aquatic macrophytes appear to have a much higher tolerance for copper (pCu < 5.0). The sensitivity of various groups of organisms seems discrepant and anomalous with accepted standards for drinking water and industrial discharges, and recommended rates of copper sulfate application to water bodies. The toxicity of copper, however, is mitigated by the presence of naturally occurring organic compounds in waters through complexation. The regulatory function of dissolved humic matter will continue to be a vital one for as long as copper is discharged into aquatic environments. (Author's abstract)
W88-02731

DEVELOPMENT AND TESTING OF A WATER BALANCE MODEL FOR CLIMATE IMPACT ASSESSMENT: MODELING THE SACRAMENTO BASIN,
California Univ., Berkeley. Energy and Resources Group.
P. H. Gleick.
Water Resources Research WRERAQ, Vol. 23, No. 6, p 1049-1061, June 1987. 6 fig, 6 tab, 55 ref.

Descriptors: *Climatic impact, *Air pollution effects, *Hydrologic budget, *Climatology, *Hydrologic models, *Model studies, *Model testing, *Data interpretation, Environmental effects, Sacramento Basin, California, Climatic data, Hydrologic aspects, Watersheds, Hydrologic data, Temperature effects, Air pollution, Mathematical equations, Available water, Runoff, Soil water.

Within the next few decades, changes in global temperature and precipitation patterns caused by increasing atmospheric concentrations of carbon dioxide and other trace gases are likely to appear. At present, the regional hydrologic impacts of such climatic changes cannot be evaluated with any certainty. Using modified water balance methods, a model of a critical hydrologic basin, the Sacramento Basin in California, is developed and tested for the purpose of investigating the effects on water availability of changes in climate. This basin was chosen because of the importance of its water supplies to agricultural and industrial productivity and because of the quality and quantity of the hydrologic data available. The water balance model is capable of reproducing both the magnitude and the timing of monthly and seasonal runoff, as well as changes in soil moisture conditions. The results suggest that the application of such models may provide considerably more information on regional hydrologic effects of climatic changes than is currently available. Such information is likely to have important ramifications for long-range water resource planning, for agricultural water resource development and conservation, and for industrial water use over the next several decades. (Author's abstract)
W88-02783

COMPARATIVE ABILITIES OF LEAF SURFACES TO NEUTRALIZE ACIDIC RAINDROPS: I. THE INFLUENCE OF CALCIUM NUTRITION AND CHARCOAL-FILTERED AIR,
Toronto Univ. (Ontario). Dept. of Botany.
For primary bibliographic entry see Field 2I.
W88-02794

IN VIVO AND IN VITRO ABSORPTION AND BINDING TO POWDERED STRATUM CORNEUM AS METHODS TO EVALUATE SKIN ABSORPTION OF ENVIRONMENTAL CHEMICAL CONTAMINANTS FROM GROUND AND SURFACE WATER,
California Univ., San Francisco. School of Medicine.
For primary bibliographic entry see Field 5B.
W88-02795

DENITRIFICATION IN AQUIFER SOIL AND NEARSHORE MARINE SEDIMENTS INFLUENCED BY GROUNDWATER NITRATE,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
J. M. Slater, and D. G. Capone.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 6, p 1292-1297, June 1987. 6 fig, 3 tab, 37 ref. NSF Grants OCE-84-17595 and OCE-85-15886.

Descriptors: *Water pollution effects, *Denitrification, *Aquifers, *Path of pollutants, *Fate of pollutants, *Sediments, *Groundwater pollution, *Nitrates, Sulfates, Reducing conditions, Sugars, Glucose.

Rates of denitrification were estimated at various depths in sediments known to be affected by submarine discharge of groundwater, and also in the parent aquifer. Surface denitrification was only measured in the autumn; at 40-cm depth, where groundwater-imported nitrate has been measured, denitrification occurred consistently throughout the year, at rates from 0.14 to 2.8 ng-atom of N/g/d. Denitrification consistently occurred below the zone of sulfate reduction and was sometimes comparable to it in magnitude. Denitrification occurred deep (14 to 40 cm) in the sediments along 30 km of shoreline, with highest rates occurring where groundwater input was greatest. Denitrification rates decreased with distance offshore, as does groundwater influx. Added glucose greatly stimulated denitrification at depth, but added nitrate did not. High rates of denitrification were measured in the aquifer (17 ng-atom N/g/d), and added nitrate did stimulate denitrification there. The denitrification measured was enough to remove 46% of the nitrate decrease observed between 40- and 14-cm depth in the sediment. (Author's abstract)
W88-02869

EUTROPHICATION ASSESSMENT IN GREEK COASTAL WATERS,
Institute of Oceanographic and Fisheries Research, Athens (Greece).
N. Friligos.
Toxicological and Environmental Chemistry TXECBP, Vol. 15, No. 3, p 185-196, 1987. 2 fig, 5 tab, 26 ref.

Descriptors: *Water pollution effects, *Eutrophication, *Coastal waters, *Greece, *Nutrients, Water pollution, Seasonal variation, Pagassitikos Gulf, Aegean Sea, Water currents.

An attempt is made to assess eutrophication in Greek coastal waters, since the measurements made to date at a few stations do not suffice. For more accurate seasonal variations in the nutrient contents, the water masses and their volumes are taken into account. The Pagassitikos Gulf is given as an example and compared to other polluted areas in the Aegean. The variations in the levels of nutrients are due to differences in the sources, as well as the morphology of the bottom and the circulation of waters. (Author's abstract)
W88-02882

ACID RAIN: AN OVERVIEW,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
For primary bibliographic entry see Field 5B.
W88-02905

NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM,
Interagency Task Force on Acid Precipitation, Washington, DC.
For primary bibliographic entry see Field 5B.
W88-02906

ECOLOGICAL EFFECTS OF ALUMINUM COMPLEXES ON FRESHWATER FISH AND THEIR ENVIRONMENTS,
Cincinnati Univ., OH. Dept. of Environmental Health.
T. K. Morris, and G. L. Krueger.
IN: Acid Precipitation Series, Volume 1: Meteorological Aspects of Acid Rain, Butterworth Publishers, Boston. 1984. Volume edited by Chandrakant M. Bhumralkar. Series edited by John I. Teasley. p 231-239, 6 tab, 34 ref.

Descriptors: *Water pollution effects, *Acid rain, *Aluminum compounds, *Fish, *Toxicity, Chelation, Trout, Acidic water, Metals.

A soluble inorganic monomeric aluminum complex of unknown chemical identity and properties has been suggested as the principal toxic agent to acid-stressed fish at a pH of approximately 5. Addition of certain chelating agents or ligands, as exemplified by citrate and fluoride, is associated with a marked decrease in acute toxicity to fish; the formation of an aluminum chelate has been assumed. Further investigation of bioaccumulation and metabolism of organically bound Al(3+) complexes which could be formed in the course of lake restoration is recommended. (See also W88-02904) (Cassar-PTT)
W88-02917

EFFECTS OF ACIDIC PRECIPITATION ON ATLANTIC SALMON RIVERS IN NEW ENGLAND,
Maine Univ. at Orono. Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W88-02927

SENSITIVITY OF STREAM BASINS IN SHENANDOAH NATIONAL PARK TO ACID DEPOSITION,
Geological Survey, Richmond, VA. Water Resources Div.
D. D. Lynch, and N. B. Dise.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4115, 1985. 61 p, 14 fig, 11 tab, 68 ref.

Descriptors: *Acid rain, *Acid streams, *Virginia, *Water pollution effects, *Shenandoah National Park, Water quality, Ion exchange, National parks, Alkalinity, Rainfall impact.

Six synoptic surveys of 56 streams that drain the Shenandoah National Park, Virginia, were conducted in cooperation with the University of Virginia to evaluate sensitivity of dilute headwater streams to acid deposition and to determine the degree of acidification of drainage basins. Flow-weighted alkalinity concentration of most streams is below 200 microequivalents per liter, which is considered the threshold of sensitivity. Streams draining resistant siliceous bedrocks have an extreme sensitivity (alkalinity below 20 microequivalents/L); those draining granite and granodiorite have a high degree of sensitivity (20 to 100 microequivalents/L); and streams draining metamorphosed volcanics have moderate to marginal sensitivity (100 to 200 microequivalents/L). A comparison of current stream water chemistry to that predicted by a model based on carbonic acid weathering reactions suggests that all basins in the Park shows signs of acidification by atmospheric deposition. Acidification is defined as a neutralization of stream water alkalinity and/or an increase in the base cation weathering rate. Acidification averages 50 microequivalents/L, which is fairly evenly distributed in the Park. However, the effects of acidification are most strongly felt in extremely sensitive basins, such as those underlain by the Antietam Formation, which have stream water pH values averaging 4.99 and a mineral acidity of 7 microequivalents/L. (USGS)
W88-03017

BLUE-GREEN ALGAE TOXICITY IN BLACK LAKE, KOOTENAI COUNTY, IDAHO,
Idaho Univ., Moscow. Dept. of Fish and Wildlife.
J. Kann, and C. M. Falter.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-157385/AS. Price codes: A04 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute Completion Report, Moscow. September 1985. 55 p, 29 fig, 3 tab, 32 ref. Contract No. 14-08-0001-G903. Project No. USGS G903-01.

Descriptors: *Idaho, *Eutrophication, *Feedlot runoff, *Algal toxins, *Cyanophyta, *Black Lake, *Nostoc commune, Water pollution effects, Eutrophic lakes, Toxicity, Phytoplankton.

Black Lake in northern Idaho has experienced massive late summer and fall growths of toxic algae, Nostoc Commune. Fatal toxicity to cattle and small mammals has resulted in three of the last four years. Environmental and phytoplankton parameters were monitored during summer and fall 1984 in order to delineate conditions required to cause toxicity. No toxic bloom occurred in 1984 despite favorable conditions in the form of high algal growth potentials and N:P ratios favoring blue-greens. Possible reasons for the absence of a toxic bloom include climatological trends and stratification pattern. Lack of a well developed hypolimnion along with the absence of a protracted calm, bright, and warm fall may override favor-

able conditions present, precluding a toxic bloom. (Idaho WRRI)
W88-03160

MICROBIAL SULFATE REDUCTION IN EXTREMELY ACID LAKES,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 5G.
W88-03174

EFFECTS OF ALLUMINUM AND ACIDITY ON THE DRIFT, MORTALITY, AND MOLTING OF STREAM INSECTS,
New Hampshire Univ., Durham. Dept. of Zoology.
W. Cook, and J. Haney.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-198082/AS. Price codes: A03 in paper copy, A01 in microfiche. New Hampshire Water Resources Research Center, Durham, Research Report 49. January 1986. 47 p, 16 fig, 1 tab, 32 ref. Contract No. USGS G-920-03. Project No. A-062-NH.

Descriptors: *Water pollution effects, *Acid rain, *Aluminum, *Macroinvertebrates, Toxicity, New Hampshire, Hydrogen ion concentration.

Responses of nine stream insects to short term increases of acidity and aluminum concentrations in artificial streams were studied. For the mayflies studied (Stenonema modestum Ephemerella subvaria and E. catawba) drifting behavior increased when aluminum concentrations were elevated above 1 ppm and mortality was increased at pH 5. Three of the four caddisflies studied (Hydropsyche ssp., Macrostemum zebratum, and Chimarra obscurra) were affected by increased salinities in high aluminum treatments, but were not adversely affected by short term increases in acidity or aluminum concentrations. The fourth caddisfly studied (Potamyia flava) suffered increased mortality at pH 5, and when aluminum concentrations rose above 1 ppm. The stonefly (Amphinemura nigritta) had high total population losses at high aluminum concentrations and at pH 5. The water penny beetle (Psephenus herricki) showed no response to short term water chemistry alterations, but long term exposure to reduced pH resulted in high drift losses of this insect. Molting success of the insects was reduced by increased acidity. (Haney-U. NH)
W88-03188

ACIDIFICATION OF FOREST SOILS: MODEL DEVELOPMENT AND APPLICATION FOR ANALYZING IMPACTS OF ACIDIC DEPOSITION IN EUROPE,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
P. Kauppi, J. Kamari, M. Posch, L. Kauppi, and E. Matzner.
Ecological Modelling ECMODT, Vol. 33, No. 2-4, p 231-253, October 1986. 9 fig, 3 tab, 24 ref, append.

Descriptors: *Acidification, *Forest soils, *Acidic soils, *Model studies, *Water pollution effects, *Fate of pollutants, *Acid rain, *Europe, Rainfall, Hydrogen ion concentration, Stress, Path of pollutants, Sulfur, Acidity, Chemical properties, Soil chemistry, Maps, Environmental effects, Air pollution.

A dynamic model is introduced for describing the acidification of forest soils. In one-year time steps, the model calculates the soil pH as a function of the acid stress and the buffer mechanisms of the soil. The concepts 'buffer rate' and 'buffer capacity' are used to quantify the buffer mechanisms. The model compares the rate of acid stress (annual amount) with the buffer rate, and the accumulated acid stress (over several years) with the buffer capacity. These two comparisons give an estimate of the soil acidity. The model was incorporated into the Regional Acidification Information and Simulation (RAINS) model system of the International Institute for Applied Systems Analysis for analyzing acidic deposition in Europe. Data on acid stress entering the soils were obtained from other submodels. Data on buffer rate and capacity were collected from soil maps and geological maps. The model system as a whole is now available for analyzing the impact of different emission scenarios. The soil acidification model assumes sulfur deposition estimates from the other submodels as input, and as output it produces estimates of the acidity of European forest soils in a map format. It also computes the total area of forests in Europe with the estimated soil pH lower than any selected threshold value. Sources of uncertainty in the soil acidification model are listed and briefly evaluated. (Author's abstract)
W88-03195

CHANGES IN THE FAUNAL COMPOSITION OF TWO THERMAL STREAMS NEAR TAUPO, NEW ZEALAND,
Department of Scientific and Industrial Research, Taupo (New Zealand). Taupo Research Lab.
For primary bibliographic entry see Field 6G.
W88-03198

RELATIONSHIPS OF RAINFALL, RIVER FLOW, AND SALINITY TO FAECAL COLIFORM LEVELS IN A MUSSEL FISHERY,
Department of Health, Wellington (New Zealand).
R. L. Brock, G. R. Galbraith, and B. A. Benseman.
New Zealand Journal of Marine and Freshwater Research NZJMBS, Vol. 19, No. 4, p 485-494, 1985. 2 fig, 6 tab, 8 ref.

Descriptors: *Rainfall, *River flow, *Salinity, *Coliforms, *Mussels, *Fisheries, *New Zealand, *Water pollution effects, *Fate of pollutants, *Marlborough Sound, *Pelorus Sound. Shellfish farming, Bacteria, Aquatic bacteria, Mollusks, Aquaculture, Microbiological studies, Tissue analysis, Water pollution, Water pollution effects, Pollutant identification, Water quality management.

Fecal coliform levels were determined for sea water and shellfish flesh from farms of the green mussel Perna canaliculus in Pelorus Sound, Marlborough Sounds, New Zealand. Simple linear models were developed to relate logarithmically transformed data on the fecal coliform levels to measures of fresh water entering the mussel beds. These models support guidelines to restrict harvesting following periods of heavy rain in order to comply with shellfish sanitation standards. Alternative guidelines are suggested based on the volume of river water entering the sound or salinity. (Author's abstract)
W88-03199

ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY FOR MAJOR RESOURCE DEVELOPMENTS,
Department of the Environment, Hull (Quebec).
For primary bibliographic entry see Field 6G.
W88-03211

EFFECTS OF RESIDUAL SOIL SALINITY RESULTING FROM IRRIGATION WITH SULPHATE WATERS ON LETTUCE,
Agricultural Research Inst., Nicosia (Cyprus).
For primary bibliographic entry see Field 3C.
W88-03215

POTENTIAL FOOD CHAIN EFFECTS FROM LAND APPLICATION OF SLUDGES,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
H. A. Elliott.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 357-364, 2 tab, 11 ref.

Descriptors: *Water pollution effects, *Land disposal, *Food chains, *Waste disposal, *Sludge disposal, *Sludge, Agriculture, Human health, Trace metals, Organic compounds, Hazardous materials, Pathogens, Human pathology, Sludge utilization.

An overview of the major food chain effects associated with the agricultural use of sludge is presented, and the treatment of the potential problems by the formulation of the Northeast Guidelines was described. The concerns for human health related to trace elements, toxic organics, and pathogens were evaluated for each of the three mechanisms for transfer of harmful constituents to the food chain, uptake/translocation by crops, adherence to low-growing and subsurface crops consumed directly by humans, and sludge ingested by animals grazing on treated pastures. The evaluation of the risks showed that fear of food contamination is justified, but that the risk of health effects from contaminated food grown on properly managed sludge application sites is probably several orders of magnitude less than the risks associated with many other daily activities. Alternatives to sludge disposal on agricultural land are also discussed. (See also W88-03223) (Wood-PTT)
W88-03248

ANALYSIS OF VIRUS 'DIE-OFF' IN LAND-APPLIED INDUSTRIAL WASTES AND SLUDGES,
Algal Research Center, Landenberg, PA.
For primary bibliographic entry see Field 5E.
W88-03249

EFFECTS OF LIQUID ORGANIC CONTAMINANTS ON GEOTECHNICAL PROPERTIES OF CLAY SOILS,
New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering.
P. C. Chan, G. Selvakumar, and C. Y. Shih.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 409-420, 8 fig, 4 ref.

Descriptors: *Water pollution effects, *Soil contamination, *Clays, *Chemical properties, *Organic compounds, *Soil physical properties, *Soil mechanics, *Phenol, Hazardous materials, Soil chemistry, Geotechnical properties, Soil structure, Soil strength, New Jersey, Mathematical equations, Soil water, Soil density.

The interaction of hazardous substances with soils and the effects of these substances on the geotechnical properties of the soils are of interest to geotechnical engineers who use the information to predict possible changes in the index properties, strength and compressibility characteristics of the soil. In the case of clay soils, due to the surface negative charge, the adsorption of dipolar substances is inevitable due primarily to hydrogen bonding. Both adsorption and the consequent desorption in washing were investigated simultaneously with the determination of geotechnical properties using kaolinite, illite, montmorillonite, and a wide spectrum of clay soils from New Jersey. Different concentrations of liquid phenol were used in the experiments. Both liquid and plastic limits were influenced by the concentration of the organic liquid; appropriate mathematical equations are given. Optimum dry density and optimum moisture content were affected by the concentration of liquid phenol. It was also found that the variation of the maximum compression strength with respect to the concentration of liquid phenol was insignificant. (See also W88-03223) (Wood-PTT)
W88-03254

USE OF FIELD AND LABORATORY BIOLOGICAL TECHNIQUES TO EVALUATE THE TOXIC IMPACT OF A COMBINED INDUSTRIAL AND MUNICIPAL DISCHARGE,
Virginia State Water Control Board, Richmond.
D. K. Paylor, R. W. Ayers, and J. R. Bell.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 462-471, 3 fig, 3 tab, 8 ref.

Descriptors: *Water pollution effects, *Toxicity, *Combined wastewater, *Municipal wastewater, *Industrial wastewater, Chemical analysis, Field

tests, *South Anna River, Textile mill wastes, Industrial wastes, Prediction, Water pollution sources, Stream pollution, Water pollution, Lethal limit, Virginia.

In August 1984 the toxicity of wastewater discharged into the South Anna River in Virginia was assessed using in situ and laboratory tests. The Town of Gordonsville operates a secondary biological sewage treatment plant which receives approximately 50% of its combined industrial/municipal wastewater flow from a textile industry. The textile raw wastewater influent to the municipal plant was demonstrated to be toxic to aquatic organisms at wastewater concentrations of less than 1% using effluent toxicity tests. The toxicity was not reduced in the final dechlorinated discharge as measured by the 7-day tests using Ceriodaphnia affinis and Pimephales promelas. The fact that toxicity was not reduced by domestic sewage may be due to other sources of toxicity or residual toxicity in the secondary lagoon sludge. Chronic toxicity data were used to predict that there would be considerable in-stream impact since the streams are effluent dominated with in-stream wastes concentrations of greater than 50-70% during most of the year. Close agreement between laboratory and field studies was observed. Chemical analysis did not reveal a source of toxicity and it is hypothesized that additive or antagonistic interactions may occur between constituents of a complex effluent which affect the toxicity differently from the way that is expected on the basis of individual chemical analysis. In this case, sole reliance on chemical testing would have resulted in a false prediction of no toxicity. (See also W88-03223) (Wood-PTT)
W88-03259

EFFECTS OF OIL EXPOSURE ON PINK SALMON, ONCORHYNCHUS GORBUSCHA, ALEVINS IN A SIMULATED INTERTIDAL ENVIRONMENT,
National Marine Fisheries Service, Auke Bay, AK. Auke Bay Lab.
A. Moles, M. M. Babcock, and S. D. Rice.
Marine Environmental Research MERSDW, Vol. 21, No. 1, p 49-58, 1987. 3 fig, 3 tab, 15 ref.

Descriptors: *Water pollution effects, *Oil pollution, *Estuaries, *Fish, *Salmon, Oil, Alevins, Hydrocarbons, Fish physiology, Fish toxins, Seawater, Tidal waters.

Pink salmon, Oncorhynchus gorbuscha, alevins (5 and 60 days after hatching) were continuously or intermittently exposed for 30 days to the water-soluble fraction (WSF) of Cook Inlet crude oil in freshwater or in a simulated freshwater-seawater cycle. Alevins exposed to 0.7-2.4 milligrams/liter WSF in the simulated tidal cycle were more sensitive to oil, had reduced yolk reserves, and accumulated more hydrocarbons than did alevins exposed to the same concentrations in freshwater. Alevins in fresh water were more sensitive to continuous than to intermittent exposures. In all exposures, 60-day alevins were more severely affected than were 5-day alevins. (Author's abstract)
W88-03292

INTERSITE, INTRASITE AND INHERENT VARIABILITY OF THE WHOLE SOFT TISSUE ZINC CONCENTRATIONS OF INDIVIDUAL MUSSELS MYTILUS EDULIS: IMPORTANCE OF THE KIDNEY,
Memorial Univ. of Newfoundland, St. John's.
P. B. Lobel.
Marine Environmental Research MERSDW, Vol. 21, No. 1, p 59-71, 1987. 3 fig, 2 tab, 42 ref.

Descriptors: *Water pollution effects, *Tissue analysis, *Zinc, *Mussels, *Kidneys, Mollusks, Sublethal effects, Variation coefficient, Soft tissues, Frequency distribution, Comparison studies, Hawke's Bay.

Mussels, Mytilus edulis, were collected from a highly contaminated site near a zinc mine in order to determine the zinc concentrations of the whole soft tissue, as well as that of individual organs. Mean concentrations of zinc in these mussels were relatively low (< 220ppm dry weight) in tissues other than the kidney, with low coefficients of variation (CV = 15-28%). In contrast, the mean zinc concentration of polluted kidney tissue was very high (6842 ppm) with a remarkable degree of variability (CV = 74%). Variations observed in the zinc concentration in kidneys were found to be responsible for the high degree of variability (CV = 44%) found in the whole soft tissue zinc concentrations at this site. These results from polluted mussels at the contaminated site were compared with the results of a previous similar study of unpolluted mussels at an unpolluted site. Although all the mean zinc concentrations of individual organs were significantly lower in the unpolluted Bellevue mussels than in the contaminated Hawke's Bay mussels, the basic pattern of accumulation was essentially the same with the unpolluted kidney showing the highest mean zinc level (828 ppm) and the highest degree of variability (CV = 78%) of any organ at the uncontaminated site. The mean whole soft tissue zinc concentration of the polluted mussels was about twice as high as that of the unpolluted mussels, while the mean kidney zinc concentration of the contaminated mussels was 8-fold greater than that found in the unpolluted animals. It was concluded that the kidney is the prime determinant of the intersite, intrasite and inherent variability of zinc concentration in the mussel. (Author's abstract)
W88-03293

GROWTH OF ESCHERICHIA COLI IN A PULP AND CARDBOARD MILL,
National Board of Waters, Helsinki (Finland).
For primary bibliographic entry see Field 5E.
W88-03472

ASSESSMENT OF CHEMICAL AND BIOLOGICAL SIGNIFICANCE OF ARSENICAL SPECIES IN THE MAURICE RIVER DRAINAGE BASIN (N.J.). PART I. DISTRIBUTION IN WATER AND RIVER AND LAKE SEDIMENTS,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5A.
W88-03475

ASSESSMENT OF CHEMICAL AND BIOLOGICAL SIGNIFICANCE OF ARSENICAL SPECIES IN THE MAURICE RIVER DRAINAGE BASIN (N.J.). PART II. PARTITIONING OF ARSENIC INTO BOTTOM SEDIMENTS,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5A.
W88-03476

ASSESSMENT OF CHEMICAL AND BIOLOGICAL SIGNIFICANCE OF ARSENICAL COMPOUNDS IN THE MAURICE RIVER DRAINAGE BASIN (N.J.). PART III. TRANSFORMATIONS IN AEROBIC AND ANAEROBIC CONDITIONS,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5B.
W88-03477

CONTRIBUTION OF TAP WATER TO MINERAL INTAKES OF CANADIAN PRESCHOOL CHILDREN,
Guelph Univ. (Ontario). Dept. of Nutrition.
R. S. Gibson, P. S. Vanderkooy, C. E. McLennan, and N. M. Mercer.
Archives of Environmental Health AEHLAU, Vol. 42, No. 2, p 165-169, May/June 1987. 1 fig, 2 tab, 17 ref.

Descriptors: *Water pollution effects, *Drinking water, *Diets, *Minerals, *Nutrients, Canada, Metals, Acidity, Alkalinity, Tap water.

Tap water consumption was estimated from 3 day weighed dietary records in 102 Canadian preschool children (4-5 yr of age; 58 males, 44 females). Cold tap water samples were also collected from each child's household (64 hard water households, 38 soft water households) and analyzed for calcium, magnesium, sodium, zinc, copper, and sodium by atomic absorption spectrophotometry. Median consumption of tap water consumed alone and tapwater alone plus that used in beverages (ml per day) was 36.5 (range 0-791) and 171.5 (range 0-1036), respectively. Average intakes of macrominerals for males (M) and females (F) from all sources of hard tap water were (mg/day): calcium (M) 16.5, (F) 13.2; magnesium (M) 6.6, (F) 4.5; and sodium (M) 2.3, (F) 2.3. Average intakes of macrominerals from soft water are as follows: calcium (M) 0.1, (F) 0.1; magnesium (M) 0, (F) 0; and sodium (M) 31.0, (F) 24.4. Trace element intakes from tap water were negligible. Hard tap water provided less than 8% of the Canadian Recommended Nutrient Intake (RNI) for magnesium, less than 3% for calcium, and less than 1% for zinc. Mineral contributions of soft tap water to the RNIs were less than 2%. (Author's abstract)
W88-03478

EFFECTS OF PH AND FEEDING REGIME ON METHYLMERCURY ACCUMULATION WITHIN AQUATIC MICROCOSMS,
Ontario Hydro, Toronto.
For primary bibliographic entry see Field 5B.
W88-03480

5D. Waste Treatment Processes

HANDBOOK OF OZONE TECHNOLOGY AND APPLICATIONS.
Volume 1. Ann Arbor Science, Ann Arbor, MI. 1982. 386 p. Edited by Rip G. Rice and Aharon Netzer.

Descriptors: *Wastewater treatment, *Ozone, *Water treatment, *Ozonation, Water treatment facilities, Chemical treatment, Organic compounds, Water quality control.

This book addresses the history of ozone technology, methods of generation, principles of mass transfer and contacting of ozone with aqueous systems, effects of ozone on materials of construction, analysis and control of ozone in aqueous systems, engineering aspects of ozonation systems and mechanisms of reactions of ozone with organic materials in aqueous media. (See W88-02504 thru W88-02512) (Lantz-PTT)
W88-02503

HISTORICAL BACKGROUND, PROPERTIES AND APPLICATIONS,
Oklahoma State Univ., Stillwater. School of Chemical Engineering.
For primary bibliographic entry see Field 5F.
W88-02504

MASS TRANSFER OF OZONE INTO AQUEOUS SYSTEMS,
Mississippi State Univ., Mississippi State. Dept. of Chemical Engineering.
C.-H. Kuo, and F. H. Yocum.
IN: Handbook of Ozone Technology and Applications. Volume 1. Ann Arbor Science, Ann Arbor, MI. 1982. p 105-141, 7 fig, 1 tab, 71 ref.

Descriptors: *Mass transfer, *Ozone, *Water treatment, *Wastewater treatment, Water quality control, Diffusion, *Ozonation, Chemical reactions, Absorption, Gas-liquid chromatography.

Diffusion is important in each step of ozonation in water and wastewater treatment. This includes diffusion of ozone through the gas phase into an interface between the gas and liquid phases, transport across the interface to the liquid phase boundary, and then transfer into the bulk liquid. Fundamental concepts governing transport of a gas into the liquid phase, are discussed, effects of chemical reactions on the rate of mass transfer are predicted, and various theoretical and experimental investigations of ozone absorption into the aqueous solutions are reviewed. The chapter concludes with a brief discussion of the advantages and disadvantages of many gas-liquid contacting systems that

have been used to conduct ozonation reactions. (See also W88-02503) (Lantz-PTT)
W88-02505

CONTACTING OF OZONE WITH WATER AND CONTACTOR OFFGAS TREATMENT,
Compagnie Intercommunale Bruxelloise des Eaux (Belgium).
W. J. Masschelein.
IN: Handbook of Ozone Technology and Applications. Volume 1. Ann Arbor Science, Ann Arbor, MI. 1982. p 143-224, 47 fig, 7 tab, 37 ref.

Descriptors: *Water treatment, *Ozone, *Wastewater treatment, *Contactors, *Ozonation, Chemical reactions, Solubility, Suspended solids, Biological treatment, Chemical treatment, Costs, Economic aspects, Water quality control.

Dissolution of ozone is said to occur by gas transfer in an exchange process described by the double-film theory. Several fundamental aspects of this theory, have a practical incidence on the methods for transfer. A question for further development is the duality (or perhaps the complementary aspect of the action) of dissolved residual ozone and the concentrated ozonated bubble reaction mechanism. According to present evidence, the fast reaction of suspended matter and even bactericidal action could take place favorably in the mixed reactor, while the slower reaction with more resistant compounds requires dissolved ozone (batch-type reaction). The implications of this duality on the selection, operation and costs of the different contacting systems are discussed on a comparative basis. The aim of this chapter is to cast a critical eye on the different parameters of ozone contacting systems so as to provide a basis for: (1) guidelines for further research on the subject; (2) criteria for selecting the most appropriate equipment in any particular water quality circumstance; and (3) stimulation to achieve still further progress in this field in which several 'shadowy' points still remain regarding ozone reactivity and actual yield of dissolution attainable with existing contacting systems. (See also W88-02503) (Lantz-PTT)
W88-02506

RECENT EXPERIMENTAL STUDIES DEALING WITH CORROSION AND DEGRADATION OF MATERIALS IN OZONE-CONTAINING ENVIRONMENTS,
Union Carbide Corp., Tonawanda, NY. Linde Div.
For primary bibliographic entry see Field 8G.
W88-02507

ANALYSIS OF OZONE IN AQUEOUS SOLUTION,
North Carolina Univ., Chapel Hill.
J. Stanley, and J. D. Johnson.
IN: Handbook of Ozone Technology and Applications. Volume 1. Ann Arbor Science, Ann Arbor, MI. 1982. p 255-276, 4 fig, 1 tab, 46 ref.

Descriptors: *Wastewater treatment, *Water treatment, *Ozone, *Chemical analysis, *Analytical methods, *Ozonation, Monitoring, Chemical reactions, Hydrogen ion concentration, Molecular structure, Electrochemistry, Gas-phase measurements.

In applications where dissolved ozone concentrations are maintained in solution, dissolved residual ozone measurements assist in control and evaluation of process performance. Ozone residuals are observed once the spontaneous ozone demand of the solution has been satisfied. Total ozone demand consists of three factors: (1) relatively slow, continuous decomposition of ozone to oxygen; (2) conversion of ozone molecules to hydroxyl radicals, which occurs rapidly only at high pH values; and (3) often fast, chemical reduction of the ozone molecule by reaction with oxidizable constituents of the solution. These chemical reductions of the ozone molecule often produce new oxidants, which may mistakenly be measured as residual ozone. The use of residual ozone measurements to control ozonation processes is most common in the disinfection or oxidation of drinking water supplies. Here, in contrast to wastewater treatment, the ozone demand can be satisfied by applying excess ozone to obtain a residual ozone concentration and thus assure ozonation process completion as a measure of microbiological safety. In comparison with aqueous analytical methods, gas-phase measurements of ozone can be performed with relative accuracy and freedom from interferences. The present availability and use of analytical techniques for measurement of ozone in water are the subject of this review. Currently available methods are examined and compared in light of potential interferences and limits to detection sensitivity. Developments in the application of electrochemical methods of analysis are also reviewed. (See also W88-02503) (Lantz-PTT)
W88-02508

DESIGN ENGINEERING ASPECTS OF OZONATION SYSTEMS,
Purdue Univ., Lafayette, IN.
C. M. Robson.
IN: Handbook of Ozone Technology and Applications. Volume 1. Ann Arbor Science, Ann Arbor, MI. 1982. p 307-337, 11 fig, 1 tab, 17 ref.

Descriptors: *Design criteria, *Water treatment, *Wastewater treatment, *Ozonation, *Wastewater facilities, *Water treatment facilities, Costs, Instrumentation, Energy, Ozone, Environmental effects, Drinking water.

Large, operating European and Canadian drinking water ozonation facilities, and the design and construction of two major U.S. wastewater ozonation facilities are reviewed. The design and startup experience of many U.S. facilities, and details of concern to the designers and operators responsible for ozonation systems, including those treating drinking water, domestic wastewater and industrial liquids are also reviewed. Some aspects discussed are: (1) costs; (2) process and instrumentation diagram; (3) gas preparation; (4) power supply; (5) ozone generation and dissolution; (6) ozone control; and (7) environmental considerations. (See also W88-02503) (Lantz-PTT)
W88-02511

MECHANISMS, RATES AND SELECTIVITIES OF OXIDATIONS OF ORGANIC COMPOUNDS INITIATED BY OZONATION OF WATER,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
J. Hoigne.
IN: Handbook of Ozone Technology and Applications. Volume 1. Ann Arbor Science, Ann Arbor, MI. 1982. p 341-379, 16 fig, 3 tab, 57 ref.

Descriptors: *Chemical reactions, *Organic compounds, *Ozonation, *Water treatment, *Wastewater treatment, Selectivity, Oxidation, Kinetics, Radicals.

The final products accumulating in water during ozonation reflect the mechanisms and kinetics with which the different oxidation reactions of the parent molecules and transient intermediates proceed. The goal of this chapter is to present kinetic data and to establish a framework within which observations of the chemical effects of ozonation can be localized and rationalized. Pathways of reactions and oxidants involved, direct ozone reaction with solutes, oxidations initiated by OH(-) radical reactions, overall efficiency of OH(-) radical reactions, selectivity of OH(-) radical reactions, rates and selectivities of oxidations in completely stirred and nonideal plugflow reactors, and the reactive extent of different oxidation mechanisms are discussed. (See also W88-02503) (Lantz-PTT)
W88-02512

TECHNOLOGY ASSESSMENT OF AQUACULTURE SYSTEMS FOR MUNICIPAL WASTEWATER TREATMENT,
WWI Consulting Engineers, Emeryville, CA.
H. C. Hyde, R. S. Ross, and L. Sturmer.
Available from the National Technical Information Service, Springfield, Virginia. 22161, as PB84-246347. Price codes: A07 in paper copy, A01 in microfiche. EPA Report No. EPA-600/2-84-145, August 1984. 118 p, 13 fig, 32 tab, 130 ref. EPA Contract No. 68-03-3016.

Descriptors: *Aquaculture, *Macrophytes, *Biological wastewater treatment, *Water hyacinth, *Duckweed, *Wastewater treatment, Biochemical oxygen demand, Suspended solids, Nutrients, Metals, Invertebrates, Fish.

Under the Clean Water Act of 1977 financial incentives are provided to communities that use wastewater treatment alternatives over conventional systems to reduce costs or energy consumption. In an effort to increase awareness of the potential benefits of such alternatives and to encourage their implementation where applicable, the Municipal Environmental Research Laboratory has initiated a series of Emerging Technology Assessment reports. This document discusses the applicability and technical and economic feasibility of using aquaculture systems for municipal wastewater treatment facilities. While all aquatic macrophytes have wastewater treatment potential, the greatest emphasis has been placed on the utilization of water hyacinths and, to a lesser extent, duckweed. Fish, invertebrates, and integrated systems are in the exploratory or developmental stage and, as such, are not ready for routine use. Water hyacinths have been extensively studied in the laboratory and tested at the pilot scale level. Aquaculture wastewater treatment systems consist of one or more shallow basins, ponds, or raceways in which one or several species of aquatic organisms are grown. Under most conditions, the cost of an aquaculture system is less than or equal to the cost of a conventional system. Energy demands for an aquaculture system are 80 to 90% less than a conventional system. Aquaculture systems are usually limited to suburban communities because of the large land area requirements. Recommendations for future aquaculture research include optimization of basin design, testing of design criteria, documentation of costs and labor requirements, and the development of alternative plant systems. (See also W88-02563) (Geiger-PTT)
W88-02587

HAZARDOUS WASTE MANAGEMENT HANDBOOK.
Butterworths, London, England. 1985. 305 p. Edited by Andrew Porteous.

Descriptors: *Hazardous wastes, *Waste disposal, *Waste treatment, *Waste management, Leachates, Legal aspects, Solidification, Landfills, Water quality, Recycling, Radioactive wastes.

Hazardous wastes management in the UK has had a checkered history. Hazardous wastes were handled for many years on an 'out of sight, out of mind' principle until a few well published instances of indiscriminate or illegal disposal brought the subject into the public domain. Regulations, rules, codes of practice proliferated along with local government staff who were suddenly confronted with a quantum jump in technology and practice compared to what had gone before. A guide to these requirements is provided in this text. The text's main starting point is to quantify the nature of industrial wastes in the UK. Waste classifications, properties, hazards and methods of disposal available are also covered. This is followed by a review of the development of hazardous wastes legislation, the statutory duties of a waste disposal authority, site licensing, transport of hazardous wastes, and health and safety at work. Further chapters discuss: leachate production control and treatment; solidification processes; water quality and analytical techniques; alternatives to landfill; recycling, reclamation and waste reduction through process design; and radioactive waste disposal. (See W88-02641 thru W88-02649) (Lantz-PTT)
W88-02640

SOLIDIFICATION PROCESSES,
J. A. Clements, and C. M. Griffiths.
IN: Hazardous Waste Management Handbook,

Butterworths, London, England. 1985. p 146-166, 2 fig, 8 tab, 55 ref.

Descriptors: *Solidification, *Waste treatment, *Hazardous wastes, *Waste disposal, Organic compounds, Cement, Gypsum, Silicates, Polymers, Encapsulation, SEALOSAFE.

The solidification of toxic and hazardous wastes has been the subject of many scientific and technical papers and has resulted in the filing of many patent applications. The various systems use different permutations and combinations of the same limited range of additives. These may be either organic compounds that form various types of organic polymers or inorganic materials that mainly rely on the formation of silicate polymers. Typical inorganic additives are cement, gypsum, flue dust, fly ash, water galss and lime. Those systems that rely on the formation of a silicate or aluminosilicate polymers may, in some cases, lead to the incorporation of cations from the waste into the molecular structure of the polymer. In these cases the toxic material will not only be encapsulated but also chemically bound within the polymer mass. In sections of this chapter, some of the processes are described briefly; a list of solidification processes is included. No process has been omitted intentionally; however, the list is not claimed to be exhaustive. The systems that are described have been selected in the belief that they are the best known and are typical of a group of similar process. The differences between many of the patented systems are insignificant and it is difficult to understand why some of the latter patents were granted. Should a patent dispute arise some of the patent rights would be difficult to defend. The SEALOSAFE process is described in detail: starting with an evaluation of the waste and its suitability for treatment and ending with a review of the methods of disposing of the product. At all stages an attempt has been made to generalize the implementation of the various steps of the process by covering some of the approaches used in the other system. (See W88-02640) (Lantz-PTT)
W88-02645

ALTERNATIVES TO LANDFILL,
Re-Chem International Ltd., Southampton (England).
For primary bibliographic entry see Field 5E.
W88-02647

RECYCLING, RECLAMATION AND WASTE REDUCTION THROUGH PROCESS DESIGN,
UKAEA Atomic Energy Research Establishment, Harwell (England).
J. Bromley.
IN: Hazardous Waste Management Handbook, Butterworths, London, England. 1985. p 256-280, 3 tab, 62 ref.

Descriptors: *Waste treatment, *Waste disposal, *Process design, *Recycling, *Reclamation, *Hazardous wastes, Waste management, Costs, Economic aspects.

Where the current perception of risk from hazardous waste discharges is quantifiable and of concern, recycling in-house, recycling by companies specializing in recycling and the reduction of hazardous waste production by process redesign are all occurring to help produce a safer environment. The main driving force has been an economic one. In a few cases artificially high waste disposal costs, strict government legislation with strong enforcement control have played a part in influencing the extent of recycling. The increase in disposal costs for hazardous wastes has made many companies attempt to reduce the amount of waste they produce. This can be achieved by a number of means: (1) Changing the nature of the process so as not to produce the waste at all; (2) Recycling the waste internally within the plant; (3) Changing the nature of the waste so that it is no longer hazardous; (4) Considering the waste producing step and modifying it to produce less waste; and (5) Producing the same waste in the purer form acceptable by a recycling company. Any one or any combination of these alternatives may be used. The DOE guidelines generally start by considerinng the possibility of waste reduction. In order to illustrate this aspect of hazardous waste reduction, some examples are considered. (See also W88-02648) (Lantz-PTT)
W88-02648

DECONTAMINATION OF NITRATE POLLUTED WATER,
Minnesota Univ., Minneapolis. Dept. of Chemical Engineering.
M. M. Kreevoy, A. T. Kotchevar, and C. W. Aften.
Separation Science and Technology SSTEDS, Vol. 22, No. 2 and 3, p 361-372, February-March 1987. 6 fig, 1 tab, 20 ref. NSF Grant CHE-8215014.

Descriptors: *Wastewater treatment, *Water treatment, *Water pollution treatment, *Membrane processes, *Nitrates, Water pollution, Hydrodynamics, Ions.

Nitrate can be extracted from water at any pH below 10 by a water-insoluble quaternary ammonium 2,4,6-trimethylphenate or N-benzyl-4-methylbenzenesulfonamidate dissolved in trioctylphosphate (TOP). Membranes were prepared by taking up TOP solutions of the quaternary ammonium bases in porous polypropylene (Celgard(R)-2400). These membranes were used in a modified dialysis cell to transfer NO3(-) from near-neutral water to stripping solutions of pH, 12-14. Specific rate constants, k, in excess of .0001 cm/s were observed for nitrate removal under a wide variety of loading and stripping conditions. This is sufficient to project a practical device for the decontamination of nitrate-polluted water. When the hydrodynamic resistances in both the feed and the strip are removed by pumping these solutions through static mixers adjacent to the membrane, k is reduced by making the stripping solution less basic or by increasing its nitrate concentration. These observations suggest that the disassembly of the carrier of the NO3(-) and H(+) at the stripping interface is a step-wise process, involving energetically unfavorable, charge-separated species. (Author's abstract)
W88-02693

CONCENTRATION OF SYNFUEL PROCESS CONDENSATES BY REVERSE OSMOSIS,
Bend Research, Inc., OR.
S. B. McCray, and R. J. Ray.
Separation Science and Technology SSTEDS, Vol. 22, No. 2 and 3, p 745-762, February-March 1987. 10 fig, 6 tab, 13 ref.

Descriptors: *Wastewater treatment, *Water treatment, *Reverse osmosis, *Membrane processes, *Synfuels, Industrial wastewater, Costs, Phenols, Performance evaluation.

The use of a novel, fouling-resistant, inside-skinned hollow-fiber membrane configuration as an energy-efficient and cost-effective alternative to conventional treatment of synfuel process condensate waters is discussed. Reverse osmosis has been used in the past only to 'polish' condensate waters that were first treated by conventional means. A reverse-osmosis system actually replaces traditional biotreatment of condensate waters or replaces the solvent-extraction process in the treatment train. The membranes used in this reverse-osmosis system are capable of rejecting at least 90% of the phenols as well as high percentages of other organics contained in actual process condensate waters. Furthermore, these membranes have operated for several months on synfuel condensate waters and showed no significant decrease in performance. Energy and cost estimates of a reverse-osmosis system based on such membranes will be discussed in detail, including a comparison of operating costs of this system with the operating costs of conventional treatment systems. (Author's abstract)
W88-02694

CONCENTRATION POLARIZATION EFFECTS IN THE USE OF MICELLAR-ENHANCED ULTRAFILTRATION TO REMOVE DISSOLVED ORGANIC POLLUTANTS FROM WASTEWATER,
Oklahoma Univ., Norman. School of Chemical Engineering and Materials Science.
R. O. Dunn, and J. F. Scamehorn.
Separation Science and Technology SSTEDS, Vol. 22, No. 2 and 3, p 763-789, February-March 1987. 12 fig, 4 tab, 13 ref. DOE Contract DE-AS0584ER13175.

Descriptors: *Wastewater treatment, *Water treatment, *Membrane processes, *Ultrafiltration, *Phenols, Organic compounds, Micelles, Surfactants, Wastewater, Polarization.

Micellar-enhanced ultrafiltration (MEUF) is used to remove 4-tert-butylphenol (TBP) from aqueous solution, a separation for which traditional ultrafiltration is ineffective. A micelle-forming surfactant is added to the solution. The micelles solubilize a high fraction of the TBP. The stream is then forced through an ultrafilter. Overall rejection of TBP was greater than 99% under all conditions studied and did not decrease with increasing pressure drop. Micelles were completely rejected by membranes with pore size 10000 Dalton MWCO and below. Concentration polarization affects MEUF fluxes under conditions of interest. Gel polarization theory does not completely explain MEUF flux behavior. Selection of optimum operating parameters in MEUF application are discussed. (Author's abstract)
W88-02695

REMOVAL OF ACETIC ACID FROM WASTEWATER WITH LIQUID SURFACTANT MEMBRANES: AN EXTERNAL BOUNDARY LAYER AND MEMBRANE DIFFUSION CONTROLLED MODEL,
East China Inst. of Chemical Technology, Shanghai (China).
N.-X. Yan, S.-A. Huang, and Y.-J. Shi.
Separation Science and Technology SSTEDS, Vol. 22, No. 2 and 3, p 801-818, February-March 1987. 9 fig, 1 tab, 16 ref.

Descriptors: *Wastewater treatment, *Membrane processes, *Model studies, Prediction, Mass transfer, Extraction, Emulsions, Entrainment.

A new diffusion controlled mass transfer model has been established for uniform emulsion globules without redispersion and internal circulation. Both the external boundary layer and the membrane resistance to mass transfer are taken into account and the perturbation solutions have been obtained. Experimental data on the batch extraction of acetic acid from wastewater are in good agreement with the model predictions. Usually, the zero-order, or pseudo-steady state solution alone can give an adequate description of the process. The swell of emulsion can be classified into two types - permeation and entrainment. The swelling rate by permeation of water increases with increasing the concentration of surfactant and internal reagent. Repeated redispersion and vigorous stirring promote the swell due to the entrainment. The swelling mechanism of the entrainment has been discussed. (Author's abstract)
W88-02696

MICROBIAL DESULFONATION OF SUBSTITUTED NAPHTHALENESULFONIC ACIDS AND BENZENESULFONIC ACIDS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Mikrobiologisches.
For primary bibliographic entry see Field 5B.
W88-02705

IDENTIFICATION OF DIMETHYL DISULFIDE-FORMING BACTERIA ISOLATED FROM ACTIVATED SLUDGE,
Aichi Prefectural Inst. of Public Health, Nagoya (Japan).
B. Tomita, H. Inoue, K. Chaya, A. Nakamura, and N. Hamamura.
Applied and Environmental Microbiology AEMIDF, Vol. 53, No. 7, p 1541-1547, July 1987. 4 tab, 26 ref.

Descriptors: *Wastewater treatment, *Activated sludge, *Dimethyl disulfide, *Bacteria, Taxonomy, Species composition, Wastewater, Sludge.

Twenty-four strains with high dimethyl disulfide (DMDS)-forming ability were isolated from activated sludge and identified to the genus level. These bacteria were classified into four groups (A,B,C, and D) by the API ZYM System. Group A (three strains) was identified as genus Lactobacillus by the API 20B System, by the method of Cowan and Steel, and by production of lactic acid as confirmed by gas-liquid chromatography. Group B (eight strains) was identified as genus Corynebacterium by API 20B and the Cowan and Steel method. Group C (one strain) was suggested to belong to genus Corynebacterium by the API 20B System. Group D (12 strains) was identified as genus Pseudomonas or Alcaligenes by the API20B System, as genus Alcaligenes by the Cowan and Steel method, and as Achromobacter group Vd by the API 20NE System. However, on the basis of guanine-plus-cytosine contents in DNA and form of flagella, these strains were identified as genus Pseudomonas. Formation of DMDS from DL-methionine and S-methyl-L-cysteine was tested. DMDS-forming bacteria isolated from activated sludge formed DMDS from both precursors. In genus Pseudomonas, P. aeruginosa could not form DMDS from either precursor, but P. acidovorans, P. alcaligenes, P. pseudoalcaligenes, and P. testosteroni formed DMDS. In genus Alcaligenes, A. denitrificans subsp. xylosoxydans, A. dentrificans subsp. denitrificans, A. faecalis, and A. odorans formed DMDS from both precursors. Achromobacter group Vd formed DMDS from S-methyl-L-cysteine, but could not from DL-methionine. (Author's abstract)
W88-02709

BACTERIOPHAGES ACTIVE AGAINST BACTEROIDES FRAGILIS IN SEWAGE-POLLUTED WATERS,
Barcelona Univ. (Spain). Dept. of Microbiology.
For primary bibliographic entry see Field 5A.
W88-02711

IMMOBILIZATION OF ACTIVATED SLUDGE BY PVA-BORIC ACID METHOD,
Osaka Univ. (Japan). Dept. of Environmental Engineering.
S. Hashimoto, and K. Furukawa.
Biotechnology and Bioengineering BIBIAU, Vol. 30, No. 1, p 52-59, July 1987. 10 fig, 7 tab, 7 ref.

Descriptors: *Wastewater treatment, *Activated sludge, *Sludge immobilization, Pollution load, Organic carbon, Nitrogen, Kinetics, Costs, Chemical treatment, Boric acid.

A new method (polyvinyl alcohol-boric acid method) for an inexpensive and effective immobilization of activated sludge was developed. Using activated sludge immobilized by this PVA-boric acid method, synthetic wastewater was treated at a high loading rate of 0.5-2.35 kg TOC/cu m/day. Total organic carbon and total nitrogen were removed at efficiencies of 93 and 30-40%, respectively. The kinetic constants Y and b for this immobilized activated-sludge process were determined to be 0.594 g mixed liquor suspended solids (MLSS)/g TOC and 0.0219/day, respectively. The cost calculation of chemicals required for the immobilization of activated sludge by this PVA-boric acid method was proved to be extremely inexpensive for the immobilization of activated sludge. (Author's abstract)
W88-02713

CADMIUM ACCUMULATION BY A CITROBACTER SP. IMMOBILIZED ON GEL AND SOLID SUPPORTS: APPLICABILITY TO THE TREATMENT OF LIQUID WASTES CONTAINING HEAVY METAL CATIONS,
Oxford Univ. (England).
L. E. Macaskie, J. M. Wates, and A. C. R. Dean.
Biotechnology and Bioengineering BIBIAU, Vol. 30, No. 1, p 66-73, July 1987. 3 fig, 1 tab, 26 ref.

Descriptors: *Wastewater treatment, *Bioaccumulation, *Cadmium, *Citrobacter, *Heavy metals, Enzymes, Cations, Metals, Flow rate, Kinetics, Phosphates, Anions, Ions.

Polyacrylamide gel-immobilized cells of a Citrobacter sp. removed cadmium from flows supplemented with glycerol 2-phosphate, the metal uptake mechanism being mediated by the activity of a cell-bound phosphatase that precipitates liberated inorganic phosphate with heavy metals at the cell surface. The constraints of elevated flow rate and temperature were investigated and the results discussed in terms of the kinetics of immobilized enzymes. Loss in activity with respect to cadmium accumulation but not inorganic phosphate liberation was observed at acid pH and was attributed to the ability of these anions to complex heavy metals, especially the ability of CN(-) to form complex anions with Cd(2+). The data are discussed in terms of the known chemistry of chloride and cyanide-cadmium complexes and the relevance of these factors in the treatment of metal-containing liquid wastes is discussed. The cells immobilized in polyacrylamide provided a convenient small-scale laboratory model system. It was found that the Citrobacter sp. could be immobilized on glass supports with no chemical treatment or modification necessary. Such cells were also effective in metal accumulation and a prototype system more applicable to the treatment of metal-containing streams on a larger scale is described. (Author's abstract)
W88-02714

APPROPRIATE METHODS OF TREATING WATER AND WASTEWATER IN DEVELOPING COUNTRIES.
Ann Arbor Science, Ann Arbor, MI. 1982. 392 p. Edited by George W. Reid.

Descriptors: *Developing countries, *Water treatment, *Wastewater treatment, *Project planning, *Water supply development, Groundwater mining, Water demand, Models, Water management, Wastewater disposal, Rural areas, Filtration, Cost analysis, Wells, Sand filters.

This book contains a collection of selected manuscripts that deal with problems of water and wastewater treatment in lesser developed countries. Topics covered in the chapters include: problems of technology transfer and utilization; prediction methodology for suitable water and wastewater processes; a priority setting for the rural water supply program in Indonesia; water supply and treatment in rural areas; methods of choice for water supply and treatment; wastewater disposal and treatment; a model to predict water demand, wastewater disposal, cost of treatment systems, and equipment required; and model acceptance, lessons of history, and management concerns. The text is supplemented by an index, selected bibliography, and miscellaneous tables for determining cost and manpower requirements of single and feasible processes. (See W88-02733 thru W88-02740) (Geiger-PTT)
W88-02732

PROBLEM, INTERFACE FOR DECISION AND APPROPRIATE TECHNOLOGY-SCIENCE TECHNOLOGY, TECHNOLOGY TRANSFER AND UTILIZATION,
Oklahoma Univ., Norman. School of Civil Engineering and Environmental Science.
For primary bibliographic entry see Field 6A.
W88-02733

PREDICTION METHODOLOGY FOR SUITABLE WATER AND WASTEWATER PROCESSES,
Oklahoma Univ., Norman.
G. W. Reid, and R. Discenza.
IN: Appropriate Methods of Treating Water and Wastewater in Developing Countries. Ann Arbor Science, Ann Arbor, MI. 1982. p 27-101, 28 fig, 10 tab, 4 ref.

Descriptors: *Water treatment, *Model studies, *Wastewater treatment, *Developing countries, *Project planning, Social aspects, Cost analysis, Public health, Water quality, Computer models, Technology transfer, Water supply development, Water management, Management planning, Manpower.

A predictive model was developed to assist planners in selecting suitable water and wastewater treatment processes appropriate to the material and manpower resource capabilities of particular countries at particular times. At present the model is limited to evaluating the plausible treatment methods for a single community, but it can be modified to provide cost information on a regional basis. The model uses eighteen inputs that describe socio-economic conditions, thirty-one inputs in five main categories that decribe the indigenous resources, two inputs that describe the demographic profile, and three inputs that describe the raw water quality. The method used to assure the appropriate process selction takes two categories of raw data (socio-economic and indigenous resources) and reduces them through a weighting process to four socio-technological levels and five resource capability categories which are used with a matrix of process constrainsts (in terms of manpower and material requirements) to screen for acceptable alternative processes. The individual processes determined acceptable by the model are used to set up combinations of processes. The processes involved in the suitable combinations are located in terms of size of population group to be served and in terms of socio-technological levels, and a matrix of capital costs, operation and maintenance costs, and manpower requirements is applied. This matrix is developed by empirical analysis of data from more developed regions, regression analysis of regional or national data from developing countries, or real entries of local data. The final step in the model will provide the least cost process combination, in terms of total cost or in terms of maintenance costs, as desired. Examples of data forms used in collecting the basic information needed for the predictive model are given. (See also W88-02732) (Geiger-PTT)
W88-02734

WASTEWATER DISPOSAL AND TREATMENT,
Oklahoma Univ., Norman.
L. W. Canter, J. F. Malina, G. W. Reid, K. G. Li, and S. Lewis.
IN: Appropriate Methods of Treating Water and Wastewater in Developing Countries. Ann Arbor Science, Ann Arbor, MI. 1982. p 207-270, 6 fig, 23 tab, 58 ref.

Descriptors: *Wastewater treatment, *Wastewater disposal, *Developing countries, *Aerated lagoons, *Stabilization ponds, Land disposal, Site selection, Public health, Design criteria, Waste management, Cost analysis, Incineration, Composting, Septic tanks.

A state-of-the-art review of sewage treatment in developing countries is given with emphasis on stabilization ponds, conventional sludge treatment, aeration lagoons, land disposal, and septic tanks. Stabilization ponds are popular in developing countries as a method of treating wastewater because of the low cost, and optimum climatic conditions. The design and biological performance of waste stabilization ponds are reviewed. Aerated lagoons have the ability to handle higher loadings with a shorter detention time than that of a stabilization pond. The process design, construction, and maintenance of aerated lagoons are reviewed. Three methods of applying wastewater to land are discussed: low rate system (irrigation), surface runoff system (overland flow), and high rate system (infiltration and percolation). Combination systems are also considered. General considerations for applying land disposal are: hydraulic loading, organic loading, salt loading, nutrient loading, soil condition, site selection, crop selection, and overall system management. The use of conventional sewer systems and onsite systems (septic tanks) are compared in terms of costs and environmental effects. (See also W88-02732) (Geiger-PTT)
W88-02738

MODEL TO PREDICT WATER DEMAND, WASTEWATER DISPOSAL, COST OF TREATMENT SYSTEMS, AND EQUIPMENT REQUIRED,

Oklahoma Univ., Norman.
G. W. Reid, and M. I. Muiga.
IN: Appropriate Methods of Treating Water and Wastewater in Developing Countries. Ann Arbor Science, Ann Arbor, MI. 1982. p 271-324, 2 fig, 10 tab, 34 ref.

Descriptors: *Model studies, *Wastewater disposal, *Wastewater treatment, *Water demand, *Developing countries, Cost analysis, Prediction, Water supply development, Mathematical models, Mathematical studies, Water supply, Surveys, Regression analysis.

Mathematical modelling techniques were used to develop predictive equations for water demand, utilizing socio-economic, environmental, and technological indicators for the regions of Africa, Asia and Latin America. Data analysis indicated that water demand is a function of population, income, and a technological indicator (percentage of households connected to water supply), while wastewater disposal was found to be a function of water demand and two technological indicators (percentage of homes connected to public sewerage systems and percentage of household systems). The predictive equations for water treatment costs were found to be a function of a technological indicator (percentage cost of imported water supply materials), population, and the design capacity. The variables which gave the best correlation for wastewater treatment costs were population, design capacity, and the percentage of imported wastewater disposal materials. Multiple regression analysis was used to develop four submodels: water demand model, wastewater disposal amounts, cost of water treatment, and cost of wastewater treatment. The non-logarithmic linear form resulted in better predictive equations for the water demand and wastewater disposal models, while the log-log linear form gave better predictive equations in water and wastewater treatment cost models. Areas where additional research is needed in the models and sample problems are examined. (See also W88-02732) (Geiger-PTT)
W88-02739

MODEL ACCEPTANCE, LESSONS OF HISTORY AND MANAGEMENT CONCERNS,
Oklahoma Univ., Norman.
For primary bibliographic entry see Field 6A.
W88-02740

LAND TREATMENT OF MUNICIPAL WASTEWATER: VEGETATION SELECTION AND MANAGEMENT.
For primary bibliographic entry see Field 5E.
W88-02741

CURRENT STATUS ON THE SELECTION AND MANAGEMENT OF VEGETATION FOR SLOW RATE AND OVERLAND FLOW APPLICATION SYSTEMS TO TREAT MUNICIPAL WASTEWATER IN THE NORTH CENTRAL REGION OF THE UNITED STATES,
Gifford Pinchot National Forest, Vancouver, WA.
For primary bibliographic entry see Field 5E.
W88-02742

SELECTION OF IRRIGATION SYSTEM DESIGN,
Williams and Works, Grand Rapids, MI.
For primary bibliographic entry see Field 5E.
W88-02743

WASTEWATER CROP MANAGEMENT STUDIES IN MINNESOTA,
Minnesota Univ., St. Paul. Agriculture Extension Service.
For primary bibliographic entry see Field 5E.
W88-02744

CROP MANAGEMENT STUDIES AT THE MUSKEGON COUNTY MICHIGAN LAND TREATMENT SYSTEM,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 5E.
W88-02745

COMPARISON OF THE CROP MANAGEMENT STRATEGIES DEVELOPED FROM STUDIES AT PENNSYLVANIA STATE UNIVERSITY, UNIVERSITY OF MINNESOTA, MICHIGAN STATE UNIVERSITY, AND THE MUSKEGON COUNTY LAND TREATMENT SYSTEM,
Georgia Coastal Plain Experiment Station, Tifton.
For primary bibliographic entry see Field 5E.
W88-02746

MANAGEMENT STUDIES OF ANNUAL GRASSES AND PERENNIAL LEGUMES AND GRASSES AT THE MICHIGAN STATE UNIVERSITY WATER QUALITY MANAGEMENT FACILITY,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 5E.
W88-02747

OLDFIELD MANAGEMENT STUDIES ON THE WATER QUALITY MANAGEMENT FACILITY AT MICHIGAN STATE UNIVERSITY,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 5E.
W88-02748

VEGETATION SELECTION AND MANAGEMENT FOR OVERLAND FLOW SYSTEMS,
Cold Regions Research and Engineering Lab., Hanover, NH.
A. J. Palazzo, T. F. Jenkins, and C. J. Martel.
IN: Land Treatment of Municipal Wastewater: Vegetation Selection and Management. Ann Arbor Science, Ann Arbor, MI. 1982. p 135-154, 8 fig, 6 tab, 19 ref.

Descriptors: *Overland flow, *Wastewater irrigation, *Wastewater disposal, *Vegetation, *Soil-water-plant relationships, Forages, Grasses, Nutrient removal, Nitrogen removal, Phosphorus removal, Potassium.

Studies were conducted at the U. S. Army Cold Regions Research and Engineering Laboratory in Hanover, New Hampshire to determine which species of forage grasses should be used on overland flow systems based on their speed of establishment and long-term persistance. Data were obtained on nutrient uptake by grasses on overland flow systems to be used to develop design criteria for nutrient removal, and to determine forage grass yields and quality. Of the four grasses sown, orchardgrass and tall fescue were the most persistant over the initial three years of wastewater application. The average yield as a result of wastewater application was almost three times the average hay yield in New Hampshire and was only slightly lower than that produced at the adjacent CRREL slow rate test site. The plants were analyzed for nine elements at each harvest. None of the concentrations of the elements measured was in the deficiency or toxicity ranges, indicating that the plants were healthy under the management schemes used in this study. Annual plant uptake of nitrogen and phosphorus during seasons of wastewater application ranged between 210 and 332 kg/ha and 27 and 48 kg/ha, respectively. Grasses should receive light applications of commercial fertilizer if delays in wastewater applications occur after seeding. Grasses should also be managed to increase tolerance to cold. Wastewater solids should be controlled so that grass smothering at the point of wastewater application does not occur. (See also W88-02741) (Geiger-PTT)
W88-02749

GROWING TREES ON EFFLUENT IRRIGATION SITES WITH SAND SOILS IN THE UPPER MIDWEST,
North Central Forest Experiment Station, East Lansing, MI.
For primary bibliographic entry see Field 5E.
W88-02750

TREE SEEDLING RESPONSES TO WASTEWATER IRRIGATION ON A REFORESTED OLD FIELD IN SOUTHERN MICHIGAN,
Michigan Dept. of Natural Resources, Lansing. Water Quality Div.
For primary bibliographic entry see Field 5E.
W88-02751

STUDIES OF LAND APPLICATION IN OLD GROWTH FORESTS IN SOUTHERN MICHIGAN,
Michigan State Univ., East Lansing. Dept. of Zoology.
For primary bibliographic entry see Field 5E.
W88-02752

CONTRACT OPERATIONS - A CASE HISTORY,
Metcalf and Eddy Services, Danvers, MA.
W. Peterson, R. K. Danhauser, and L. C. Greene.
Public Works PUWOAH, Vol. 118, No. 6, p 67-71, June 1987. 3 fig.

Descriptors: *Wastewater facilities, *Wastewater treatment, *Contracts, *Contract operation, *Case studies, Winnsboro, South Carolina, Advanced wastewater treatment, Water treatment facilities, Wastewater, Wastewater management.

In 1983 the town of Winnsboro, South Carolina, upgraded its wastewater treatment plant from secondary to advanced treatment and expanded the plant's capacity to 1.6 million gallons per day of sewage. Problems during start-up and during the next two years led to a pattern of noncompliance with Federal and state regulations. Specific problems included: (1) failure to meet NPDES standards for BOD, total suspended solids, and ammonia, (2) insufficient level of staff certification, (3) lack of in-house laboratory testing, (4) inadequate process control leading to foaming in the aeration tanks and no return of activated sludge, (5) improper sludge treatment evidenced by digesters filled with water rather than sludge, (6) lack of a program for preventative maintenance or stocking spare parts, (7) limited emergency power in an area known for black-outs, (8) inoperable pressure filter system, and (9) difficulties in budgeting for effective improvements. Metcalf and Eddy Services was contracted by the town to operate and maintain both the wastewater and water plants for five years. A detailed description of the steps taken by the contracted company were provided and the positive results were presented. (Wood-PTT)
W88-02808

COUNTY DEVELOPS UNIQUE PLANT TO TREAT SEPTAGE,
Smally, Wellford and Nalven, Inc., Sarasota, FL.
W. C. Parsons.
Public Works PUWOAH, Vol. 118, No. 6, p 76-77, June 1987. 2 fig.

Descriptors: *Septic sludge, *Wastewater treatment, *Chorine oxidation process, *Oxidation process, *Wastewater facilities, Septage, Septic tanks, Chemical treatment, Wastewater, Wastewater oxidation, Sarasota County, Florida, Sludge, Sludge drying.

Septage, the product of septic tanks, is a partially digested offensive mixture of liquid and solid water-borne materials accumulated over several months to many years in a tank or cesspool. Although its origin is the same as raw sewage, septage is the end result of an anaerobic process that concentrates most of the original materials into a potent residue which cannot be treated by the processes used by most wastewater treatment plants except in minute quantities. A solution to the treatment of this waste was sought by Sarasota County, Florida, which had an estimated 40,000 septic tanks in 1983 and adds approximately 1,000-15,000 yearly. After evaluation of a number of processes, chlorine oxidation was recommended

because the process chemistry destroys pathogens and produces a sludge that should not reputrify and is environmentally acceptable to regulatory agencies. The principal advantages of chlorine oxidation are: (1) use of chemicals and energy only when the plant is in operation, (2) ability to handle grease without separation through increased chlorine usage, (3) lack of effect by shockloads, (4) production of sterile sludge, (5) rapid dewatering through use of polymers, and (6) previous success in treating septage. Diagrams of the plant design were provided. The constructed plant was started up in May 1986 and has run well for a year with normal maintenance costs. (Wood-PTT)
W88-02810

PURIFICATION AND SELECTIVE DETOXIFICATION OF WASTE-DUMP SEEPAGE WATER BY USING NONPOLAR ADSORPTION RESINS (REINIGUNG UND SELEKTIVE ENTGIFTUNG VON DEPONIE-SICKERWASSER UNTER EINSATZ VON UNPOLAREN ADSORBERHARZEN),
Didier-Werke A.G., Konigswinter (Germany, F.R.).
H. Bender, A. Boehm, H.-E. Buehler, and E. Hahn.
Chemieingenieurtechnik CITEAH, Vol. 59, No. 5, p 419-421, 1987. 3 fig, 1 tab, 4 ref.

Descriptors: *Seepage, *Waste dumps, *Wastewater treatment, *Resins, Leachates, Adsorption, Column chromatography, Pilot plants, Molecular structure, Polarity.

Waste-dump seepage often contains poorly degradable and sometimes highly toxic contaminants and it thus presents a considerable problem in many locations. Optimized removal of such pollutants is often achieved by application of a combination of several techniques in sequence. The coverage, selectivity, and reliability of such a sequence can be increased through use of an adsorption-resin step as the core purification unit. Given the hydrophobic nature of most classes of organic pollutants, a nonpolar resin surface should more effectively bind the pollutants the smaller their dipole moment and the larger their molecular mass. This hypothesis was tested in the laboratory and supportive results were obtained. A pilot plant based on this technology is described. The pilot plant makes use of two adsorption columns in tandem, arranged so that one can be operated to remove pollutants while the resin of the other is being regenerated, thus maximizing selectivity and efficacy. (Airone-PTT)
W88-02815

GENERAL MODEL FOR SINGLE-SLUDGE WASTEWATER TREATMENT SYSTEMS,
Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.
M. Henze, C. P. L. Grady, W. Gujer, G. V. R. Marais, and T. Matsuo.
Water Research WATRAG, Vol. 21, No. 5, p 505-515, 1987. 2 fig, 4 tab, 19 ref.

Descriptors: *Biological wastewater treatment, *Activated sludge, *Model studies, *Wastewater treatment, *Mathematical models, Computers, Computer models, Chemical oxidation, Nitrification, Denitrification, Project planning.

In 1983 IAWPRC formed a task group to facilitate the application of practical models to the design and operation of biological wastewater treatment systems. This paper is a summary of the report prepared by the task group. It presents the model development for single-sludge systems performing carbon oxidation, nitrification, and denitrification. The model includes eight fundamental processes aerobic growth of heterotrophic biomass, anoxic growth of heterotrophic biomass, aerobic growth of autotrophic biomass, decay of heterotrophic biomass, decay of autotrophic biomass, ammonification of soluble organic nitrogen, hydrolysis of entrapped particulate organic matter, and hydrolysis of entrapped organic nitrogen. Methods are suggested for characterization of wastewaters and estimation of parameter values in ways consistent with the model. Finally, techniques are presented by which the model may be implemented for both education and engineering practice. (Author's abstract)
W88-02820

EFFECT OF OXIDANTS ON MICROALGAL FLOCCULATION,
Technion - Israel Inst. of Tech., Haifa. Dept. of Environmental and Water Resources Engineering.
A. Sukenik, B. Teltch, A. W. Wachs, G. Shelef, and I. Nir.
Water Research WATRAG, Vol. 21, No. 5, p 533-539, 1987. 6 fig, 1 tab, 19 ref.

Descriptors: *Flocculation, *Wastewater treatment, *Water treatment, *Chlorine, *Ozone, *Scenedesmus, Algae, Chemical oxidation, Pretreatment of water, Chlorination.

The effects of chlorine, ozone, and chlorine dioxide on Scenedesmus sp. cultures were studied. Algal cell viability and chlorophyll concentration decreased, and the concentration of dissolved organic substances increased with increasing applied oxidant concentration. Pretreatment with chlorine dioxide (1.3 or 5 mg/l) or ozone (2.6, 4.6, or 8.1 mg/l) on algal cultures enhanced algal flocculation with alum, while prechlorination with 10 or 20 mg/l increased the required dosage of alum by 15%. Scanning electron micrographs of oxidized cells revealed drastically adverse effects upon the cell surface architecture: in addition to the oxidation of noncellular organic materials, the oxidants damaged both cell surface structures and intracellular components. A model explaining the effects of the different oxidants on microalgal flocculatiuon is suggested. (Author's abstract)
W88-02823

MOBILITY AND EXTRACTION OF HEAVY METALS FROM SEWAGE SLUDGES (MOBILITE ET EXTRACTION DES METAUX LOURDS ASSOCIES AUX BOUES DE STATIONS D'EPURATION),
Laboratoire Central des Ponts et Chaussees, Bouguenais (France).
M. Legret, L. Divet, and P. Marchandise.
Water Research WATRAG, Vol. 21, No. 5, p 541-547, 1987. 9 tab, 16 ref.

Descriptors: *Heavy metals, *Sludge, *Mercury, *Cadmium, *Nickel, *Lead, *Wastewater treatment, *Separation techniques, Acetic acid.

The distribution of heavy metals was determined in the various component phases of sewage sludges sampled at various stages of treatment and the mobility of cadmium and nickel was investigated, together with the possibility of extracting these metals from the sludges, whose agricultural use would otherwise be limited. The sludges came from a plant treating sewage from the Bordeaux urban area, including liquid wastes from a battery manufacturing plant. These sludges were characterized by very high levels of nickel and cadmium. Mixed fresh sludges, anaerobic digested sludges, autoclaved sludges, and filter press dried sludges were investigated. Aerobic stabilization of mixed fresh sludges was effected in the laboratory to make it possible to compare the behavior of the metals in aerobic and anaerobic conditions. Determination of the heavy metals dissolved in pore water revealed that nickel is the most soluble metal, while cadmium and lead are entirely associated with the solid phase. During treatment the metals become less easy to mobilize, tending to associate with the reducible and residual phases. It nevertheless seems that, in dried sludges that are to be released into the environment, all heavy metals except lead are liable to salting out, especially nickel and cadmium. Nickel is easier to extract from the sludges than cadmium, and acetic acid gives the best extraction yields. Metals are more readily extracted from the aerobic stabilized sludges than from sludges produced by other treatments. (Author's abstract)
W88-02824

ORGANIC MATTER AND NITROGEN REMOVAL BY AN ON SITE SEWAGE TREATMENT AND DISPOSAL SYSTEM,
National Technical Univ., Athens (Greece). Dept. of Civil Engineering.
A. D. Andreadakis.
Water Research WATRAG, Vol. 21, No. 5, p 559-565, 1987. 10 fig, 2 tab, 17 ref.

Descriptors: *Filter media, *Organic matter, *Rural areas, *Septic tanks, *Nitrogen compounds, *Wastewater treatment, Trenches, Suspended solids, Denitrification, Nitrates, Soil properties, Subsurface drainage.

The performance of an on site sewage treatment and disposal system consisting of a septic tank, a gravel filter, a sand filter and soil absorption trenches operated alternatively, was studied in relation to organic matter and nitrogen removal efficiency. The system was simulated with the aid of a laboratory scale model. BOD sub 5 and SS removal efficiencies averaged 92.9 and 93.4% respectively. Substantial removal of nitrogen (up to 70%) was achieved due to nitrification followed by denitrification. Removal efficiencies were found to depend on the compaction characteristics of the filter media and the soil, the hydraulic loading applied and the flow conditions (saturated/ unsaturated). The results indicate that the system under consideration is a feasible alternative for on site treatment and disposal of domestic sewage. Under favorable soil conditions the system can be applied to areas fairly dense in population (e.g. suburban areas with multistory buildings) where the conventional system is not applicable. (Airone-PTT)
W88-02826

ADSORPTION OF ORGANIC COMPOUNDS ONTO ACTIVATED CARBON,
Rome Univ. (Italy).
M. C. Annesini, F. Gironi, M. Ruzzi, and C. Tomei.
Water Research WATRAG, Vol. 21, No. 5, p 567-571, 1987. 7 fig, 1 tab, 13 ref, append.

Descriptors: *Adsorption, *Activated carbon, *Organic compounds, *Physico-chemical properties, Wastewater treatment, Sugars.

Adsorption isotherms of acetone, propionaldehyde, methyl isobutyl ketone, and sucrose from aqueous solutions onto granular activated carbon have been determined. Multi-solute data have been compared with the theoretical prediction obtained from the ideal adsorbed solution model. The agreement between calculated and observed results is satisfactory. Only the system sucrose-methyl isobutyl ketone shows significant deviation between experimental and predicted values. Therefore the model can be successfully utilized in the design of activated carbon units. (Author's abstract)
W88-02827

PERCENTILE ESTIMATION FOR WATER QUALITY DATA,
WRC Engineering, Swindon (England).
R. W. Crabtree, I. D. Cluckie, and C. F. Forster.
Water Research WATRAG, Vol. 21, No. 5, p 583-590, 1987. 3 fig, 4 tab, 28 ref, append. SERC research grant (GR/B/87870).

Descriptors: *Water quality, *Statistical methods, *Data interpretation, *Wastewater treatment, Statistical analysis, Probability distribution, England.

A survey of methods used by the Regional Water Authorities found that three techniques are commonly employed for percentile estimation of BOD and solids leads in discharged wastewater: (1) assuming a parametric probability distribution, (2) using a non-parametric percentile estimation technique, and (3) statistically testing the fit of an assumed distribution. In this study, mathematical probability distribution fitting techniques were applied to 334 water quality datasets for a variety of rivers and effluents distributed throughout England and Wales. The results indicated that the 'best' estimate of the 95 percentile from a dataset should be based upon probability distribution fitting. An untested assumption made about the underlying distribution of the data may produce an erroneous result in the subsequent water quality

consent determination. The three parametric distributions selected (normal, lognormal, and Pearson Type 3) could be fitted to half of the datasets studied. Results suggested that the Pearson Type 1 distribution may also be suitable for fitting to water quality data. The arbitrary use of non-parametric techniques may fail to make the most effective use of the information contained in the data. (Author's abstract)
W88-02829

NUTRIENT REMOVAL FROM EFFLUENTS BY AN ARTIFICIAL WETLAND: INFLUENCE OF RHIZOSPHERE AERATION AND PREFERENTIAL FLOW STUDIED USING BROMIDE AND DYE TRACERS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Centre for Irrigation Research.
K. H. Bowmer.
Water Research WATRAG, Vol. 21, No. 5, p 591-599, 1987. 6 fig, 7 tab, 19 ref.

Descriptors: *Macrophytes, *Biological filters, *Nitrogen compounds, *Wastewater treatment, *Land disposal, *Tracers, *Aeration, Rhizosphere, Gravel, Ammonium, Mineralization, Nitrification, Nitrates, Channeling, Wetlands, Dye releases, Bromides.

Effluents from rural industry can be treated by percolation through the root zones of emergent macrophytes growing in a gravel substratum. The hydrology of these systems is complex, being driven by both gravity and transpiration, and so measurements of nutrient transformations within the systems are complicated by incomplete mixing. Pulse addition of dye and bromide tracers concurrently with nutrients has been used in one such experimental artificial wetland to investigate the rates and processes of nutrient removal. The tracer was used for comparison to compensate for incomplete mixing and concentration caused by evapotranspiration. Nitrogen removal efficiency is dependent on sequential mineralization of organic nitrogen to ammonium nitrogen, followed by nitrification of the ammonium to nitrate or nitrite and denitrification of nitrate or nitrite to gaseous nitrogen products. The effluent from a rendering plant was dominated by organic and ammonium-nitrogen, and efficiency of nitrogen removal was probably impaired by inadequate rates of mineralization and nitrification. Aeration is required for the latter process. Apparently the macrophytes were not introducing sufficient oxygen into the effluent for nitrification to be complete. This may reflect an inadequate outward radial diffusion of oxygen into the rhizosphere, or the effects of channeling of the effluent in preferential flow paths around the aerating root masses, requiring changes in system design. (Author's abstract)
W88-02830

ROLE OF WOODY VEGETATION IN PREVENTING GROUND WATER POLLUTION BY NITROGEN FROM SEPTIC TANK LEACHATE,
Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
J. G. Ehrenfeld.
Water Research WATRAG, Vol. 21, No. 5, p 605-614, 1987. 2 fig, 8 tab, 46 ref.

Descriptors: *Pine Trees, *Oak trees, *Nitrogen compounds, *Leachates, *Water pollution control, *Wastewater treatment, *Wastewater disposal, *Model studies, *Septic tanks, *Groundwater pollution, Wetlands, Sand, Land use planning, Nitrates, Ammonia, Suburban areas, Plant population.

The ability of woody vegetation to remove nitrogen from septic tank leachate was studied in pine upland, oak upland and hardwood wetland habitats of the New Jersey Pinelands. The study was stimulated by the incorporation of a term for plant uptake in nutrient dilution models used for Pinelands land-use management decisions. Plant response was studied at sites involving septic tank leach fields and matched control sites for each habitat type. At each site, total biomass, net production, and tissue N concentrations for the dominant species were determined. The hardwood wetland habitat had a total biomass of 15.9 MT/ha, a net primary production of 5.4 MT/ha/yr, and a net N uptake of 75-80 kg N/ha/yr. Tissue N values for wetland trees and shrubs did not show significant differences between control and experimental sites. The pine upland communities had a biomass of 55 MT/ha and a net production of 5.7 MT/ha/yr. Net N uptake ranged from 45 kg N/ha/yr (control sites) to 56 kg N/ha/yr (experimental sites). The oak upland communities had a biomass of 59 MT/ha and a net primary production of 5.0 MT/ha/yr. Net uptake ranged from 55 kg N/ha/yr in the control sites to 63.9 kg N/ha/yr. Tissue N concentrations showed significant increases for tree but not shrub species in both upland habitats. The capacity of the upland woody plants to increase N uptake and storage appears to be related to rooting depth and to the proximity of the plants to the drain tile: only plants with deep taproots, growing close to (within 1 M) the trench showed significant increases in uptake. It is suggested that only by augmenting appropriate natural vegetation with supplementary tree plantings can upland vegetation be utilized to reduce nitrogen movement to groundwater from septic systems in sandy soil; vegetation at naturally occurring densities will not have a significant effect on water quality. (Author's abstract)
W88-02832

ANAEROBIC DEGRADATION OF NONIONIC AND ANIONIC SURFACTANTS IN ENRICHMENT CULTURES AND FIXED-BED REACTORS,
Konstanz Univ. (Germany, F.R.). Fakultaet fuer Biologie.
S. Wagener, and B. Schink.
Water Research WATRAG, Vol. 21, No. 5, p 615-622, 1987. 7 fig, 2 tab, 32 ref.

Descriptors: *Nonionic surfactants, *Methane bacteria, *Alkylbenzene sulfonates, *Wastewater treatment, *Anaerobic conditions, Surfactants, Soaps, Biological wastewater treatment, Sludge, Foaming, Sedimentation, Settling tanks.

Anaerobic biodegradation and inhibitory effects of nonionic and anionic surfactants on methanogenic fermentation were tested in incubation experiments with anoxic sediment samples and sewage sludge. Alkylsulfonates and alkylbenzenesulfonates were not degraded but inhibited methanogenesis from sludge constituents at concentrations of $>$ or $=$ 10 mg/l. Sodium dodecylsulfate was at least partly degraded after adaptation at concentrations $<$ or $=$ 100 mg/l and the sulfate group was reduced to sulfide. The polyethylene glycol moiety of alkylphenol ethoxylates was fermented to methane at concentrations $<$ or $=$ 500 mg/l whereas the alkylphenol residue probably remained unchanged. Alkylethoxylates were completely degraded to methane and CO2 at concentrations up to 1.0 g/l. Complete anaerobic degradation of this surfactant type to methane, CO2, and traces of acetate and propionate was demonstrated in a lab scale anaerobic fixed-bed reactor, either with prereduced mineral salts medium or with air-saturated artificial wastewater. This process lends itself as a suited, inexpensive means for treatment of wastewaters containing enhanced loads of nonionic surfactants, e.g. from the surfactant manufacturing or processing industry. (Author's abstract)
W88-02833

REMOVAL OF VICTORIA BLUE FROM AQUEOUS SOLUTION BY FLY ASH,
Banaras Hindu Univ., Varanasi (India).
S. K. Khare, K. K. Panday, R. M. Srivastava, and V. N. Singh.
Journal Chemical Technology and Biotechnology JCTBDC, Vol. 38, No. 2, p 99-104, 1987. 5 fig, 1 tab, 6 ref.

Descriptors: *Fly ash, *Wastewater treatment, *Victoria blue, *Solutions, *Adsorption, Diffusion, Mass transfer, Equilibrium, Dyes.

The use of fly ash for the removal of victoria blue (CI26,44045) from aqueous solution at different concentrations and pH has been investigated. The process follows first order adsorption rate expression and the rate constant was found to be .017/min at a victoria blue concentration of .0001 M and 25 C. The uptake of victoria blue by fly ash is diffusion controlled and the value of mass transfer coefficient is .0000125 cm/sec. The equilibrium data fit well in the Langmuir model of adsorption. Maximum removal was noted at pH 8.0. Low desorption of dye from adsorbent surface indicates that the process may not be essentially a reversible one. (Author's abstract)
W88-02841

ESTIMATING VOLATILE ORGANIC COMPOUND EMISSIONS FROM PUBLICLY OWNED TREATMENT WORKS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
E. Namkung, and B. E. Rittmann.
Journal Water Pollution Control Federation JWPFA5, Vol. 59, No. 7, p 670-678, July 1987. 4 fig, 11 tab, 20 ref.

Descriptors: *Wastewater treatment, *Path of pollutants, *Volatile organic compounds, *Model studies, *Activated sludge, Adsorption, Volatilization, Biodegradation, Emissions.

This study estimated the annual emission rates of individual and total VOCs from the Calumet and West-southwest Wastewater Treatment Plants (WTPs) of the Metropolitan Sanitary District of Greater Chicago (MDSGC). A mathematical model of the activated sludge treatment process was developed from the fundamentals of VOC convection, volatilization to the air, adsorption onto biological solids, and biodegradation. Actual plant operating conditions were used to estimate how much of the input VOCs are stripped to the air when the other mechanisms of VOC removal are also acting and competing with volatilization. The best estimates of total VOC emissions to the atmosphere at the Calumet and West-southwest WTPs are 10 and 42 T/a, respectively, and occur when the first-order biological reaction constant, k1, is $>$ or $=$ 0.1 cu m/g VSS-day for the biodegradable VOCs and 0.0 cu m/g VSS-day for the nonbiodegradable VOCs. Biodegradation is the most important mechanism in removal of total VOCs, volatilization is small compared to biodegradation, and adsorption is a negligible sink. The key points for successful estimation of VOC emission rate from POTWs to the air during the activated sludge treatment is to choose which compounds can be biodegraded aerobically and to properly include the actual G/Q ratio. (Author's abstract)
W88-02843

COMPARISON OF TRICKLING FILTER MEDIA,
CH2M/Hill, Corvallis, OR.
J. R. Harrison, and G. T. Daigger.
Journal Water Pollution Control Federation JWPFA5, Vol. 59, No. 7, p 679-685, July 1987. 6 fig, 3 tab, 11 ref.

Descriptors: *Wastewater treatment, *Trickling filters, *Comparison studies, Filter media, Performance evaluation, Effluents, Pollution load.

Pilot studies were conducted to determine the relative performance and operational characteristics of six major types of trickling filter media currently available. The media were tested in parallel using 1.22 m by 2.44 m deep (4 ft by 4 ft by 8 ft deep) test units. The media tested included horizontal media (consisting of horizontal redwood laths); vertical, 60 C crossflow, and 45 C crossflow plastic sheet media; a random plastic media; and conventional rock media. Performance factors tested included soluble BOD and soluble COD removal, effluent nonsettleable suspended solids concentrations, and nitrification. Operating characteristics considered included plugging potential, the presence of filter flies, and the distribution of biogrowth. The results indicated that differences in performance and operational characteristics may affect which media is selected for a particular application. In general, 60 D crossflow media dem-

onstrated superior performance at low organic loadings, while vertical media demonstrated superior performance at medium and high organic loadings. The operational characteristics of these media also tended to be superior to those of the other media tested. (Author's abstract)
W88-02844

HYDRAULICS OF HORIZONTAL SHAFT OXIDATION DITCHES,
Gutteridge, Haskins and Davey Pty Ltd., Brisbane (Australia).
K. J. Hartley.
Journal Water Pollution Control Federation JWPFA5, Vol. 59, No. 7, p 686-694, July 1987. 14 fig, 2 tab, 5 ref.

Descriptors: *Wastewater lagoons, *Hydraulic machinery, *Wastewater treatment, *Hydraulics, *Design criteria, *Aeration, *Oxidation, Velocity, Circulation, Rotors.

To date there has been no fundamental method of designing the geometry of an oxidation ditch aerated with horizontal shaft brush-type aerators. Adequate circulating velocity must be maintained to keep solids in suspension while allowing power turndown to match variations in oxygen demand. On the other hand, excessive velocity reduces oxygenation capacity. This paper develops a design method based on the pumping characteristics of horizontal shaft rotors. The effects of rotor speed and immersion, water depth, and baffling are included. Rotor power characteristics are also covered. Test results are presented to demonstrate the successful application of the method to the design of a deep (3.6 m) oxidation ditch. (Author's abstract)
W88-02845

STATE-OF-THE-ART HYDROGRAPH CONTROLLED RELEASE (HCR) LAGOONS,
ERM-Southeast, Inc., Marietta, GA.
J. Zirschsky, and R. E. Thomas.
Journal Water Pollution Control Federation JWPFA5, Vol. 59, No. 7, p 695-698, July 1987. 5 fig, 2 tab, 2 ref.

Descriptors: *Wastewater lagoons, *Hydrograph controlled release, *Wastewater treatment, *Streamflow, Water quality, Costs, Flow, Monitoring, Design standards.

In a Hydrograph Controlled Release (HCR) lagoon, wastewater is discharged from the lagoon only when the stream flow is sufficient to prevent water quality degradation. The results of a nationwide assessment of HCR systems, discussed herein, shows that such systems can be a very cost-effective means for upgrading an existing treatment system or for building a new treatment system. For ease of operation and reliability, simple flow monitoring discharge systems are recommended. Specific examples of effective systems and other design considerations are discussed in this paper. (Author's abstract)
W88-02846

SKELETON BUILDERS FOR CONDITIONING OILY SLUDGE,
Technion - Israel Inst. of Tech., Haifa. Faculty of Civil Engineering.
J. Zall, N. Galil, and M. Rebhun.
Journal Water Pollution Control Federation JWPFA5, Vol. 59, No. 7, p 699-706, July 1987. 12 fig, 5 tab, 14 ref.

Descriptors: *Wastewater treatment, *Sludge conditioning, *Skeleton builders, *Chemical treatment, Filtration, Sludge, Wastewater.

The use of physical conditioners to provide a more rigid structure to oily sludge cakes that was capable of maintaining high porosity under high pressures experienced during filter pressing was investigated. Consolidation tests and conventional tests, (specific resistance and solids yield) were performed. Determinations of elastic rebound and compressibility coefficients helped confirm that cakes from chemical conditioned oily sludge by polymers remained highly compressible while those conditioned with skeleton builders exhibited a more rigid and more incompressible structure. (Author's abstract)
W88-02847

PHOSPHATE RELEASE AND UPTAKE IN ENHANCED BIOLOGICAL PHOSPHORUS REMOVAL FROM WASTEWATER,
British Columbia Univ., Vancouver. Dept. of Civil Engineering.
Y. Comeau, B. Rabionwitz, K. J. Hall, and W. K. Olkham.
Journal Water Pollution Control Federation JWPFA5, Vol. 59, No. 7, p 707-715, July 1987. 10 fig, 2 tab, 33 ref.

Descriptors: *Wastewater treatment, *Biological wastewater treatment, *Phosphorus removal, Model studies, Anaerobic conditions, Phosphates, Bacteria.

A series of batch experiments were conducted to provide an experimental basis for a biochemical model explaining the mechanisms involved in enhanced biological phosphorus (bio-P) removal. Phosphate release under anaerobic conditions was reported with the addition of acetate, sodium hydroxide (high pH), 2,4-dinitrophenol, carbon dioxide, and hydrogen sulfide. With acetate addition, carbon storage as poly-Beta-hydroxybutyrate was found. Phosphate uptake was observed with the addition of air or nitrate. Potassium, magnesium, and calcium co-transport with phosphate was also reported. It was proposed that the concept of regulation of the pH gradient, and of the internal energy level of bacteria responsible for bio-P removal, could be used to explain phosphate release and uptake. Implications of the proposed concepts for full-scale application are discussed. (Author's abstract)
W88-02848

OPERATIONAL VARIABLES AFFECTING PERFORMANCE OF THE SELECTOR-COMPLETE MIX ACTIVATED SLUDGE PROCESS,
Amoco Oil Co., Naperville, IL.
S. R. Linne, and S. C. Chiesa.
Journal Water Pollution Control Federation JWPFA5, Vol. 59, No. 7, p 716-721, July 1987. 3 fig, 2 tab, 19 ref.

Descriptors: *Activated sludge process, *Wastewater treatment, *Microbial studies, *Reactors, Sludge, Microorganisms, Performance evaluation, Growth.

The stability of the activated sludge process is directly related to the microbial population developed in the system. Control of filamentous organism growth and sludge settleability was achieved in a bench-scale selector-complete mix reactor system. Sludge settleability, as measured by a diluted sludge volume index analysis, was a function of system substrate profile, system activity gradient, and peak potential sludge activity. These system characteristics were numerically integrated into an overall dimensionless system performance number. The system performance number could be used to assess the relative magnitude of selection pressures at work in either promoting or controlling filamentous organism growth. (Author's abstract)
W88-02849

ORGANIC CONTAMINANTS REMOVAL FOR POTABLE REUSE,
Denver Water Dept., CO.
S. E. Rogers, D. L. Peterson, and W. C. Lauer.
Journal Water Pollution Control Federation JWPFA5, Vol. 59, No. 7, p 722-732, July 1987. 5 fig, 13 tab, 35 ref.

Descriptors: *Wastewater treatment, *Organic compounds, *Coagulation, *Oxidation, *Adsorption, *Impaired water use, Effluents, Chromatography, Potable water, Organic carbon.

The Denver (Colo.) Water Department's Potable Water Reuse Demonstration Plant uses the multiple organics barriers of coagulation, oxidation, adsorption, membrane separation and aeration to produce a high quality drinking water from secondary municipal wastewater effluent. The paper describes the multiple barrier design for organics removal and presents operational experience and performance of the unit processes. Total organic carbon (TOC) serves as the primary process monitor, to provide a single measure of organic concentration. Composition of the organic contamination is determined by chromatographic methods augmented by a computerized database, which is used to describe the effect of treatment processes on the organic species. The reuse product water has a lower TOC content with fewer trace organic compounds at lower concentrations than does potable water produced from protected watersheds. (Author's abstract)
W88-02850

OZONE ABSORPTION IN WATER: MASS TRANSFER AND SOLUBILITY,
Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Anlyse des Interactions et Couplages.
A. Ouederni, J. C. Mora, and R. S. Bes.
Ozone Science and Engineering OZSEDS, Vol. 9, No. 1, p 1-12, 1987. 5 fig, 21 ref.

Descriptors: *Ozone, *Solutions, *Absorption, *Water treatment, *Wastewater treatment, *Ozonation, *Mass transfer, Henrys law, Temperature, Hydrogen ion concentration, Ions, Solubility.

Mass Transfer of ozone absorbed by water in a semi-continuous stirred reactor is studied at the lab scale. Experimental investigation using a complete factorial scheme shows a predominant effect of agitation speed and gas flow and results in a correlation for the mass transfer coefficient, k sub l (a). Solubility of ozone in water is estimated by evaluation of an apparent Henry's law constant for different temperatures (20 and 50 C), pH values (2 and 7) and at constant ionic strength (0.13). (Author's abstract)
W88-02851

CHANGES IN THE CHEMICAL NATURE OF A BIOLOGICALLY TREATED WASTEWATER DURING DISINFECTION BY OZONE,
Poitiers Univ. (France). Lab. de Chimie de l'Eau et des Nuisances.
B. Legube, M. Dore, B. Langlais, M. M. Bourbigot, and G. Gouesbet.
Ozone Science and Engineering OZSEDS, Vol. 9, No. 1, p 63-84, 1987. 4 fig, 7 tab, 24 ref.

Descriptors: *Wastewater treatment, *Ozonation, *Disinfection, Wastewater, Ozone, Bacteria, Feces, Amino acids.

Pilot plant studies were carried out on the effect of ozone on the chemical content of a secondary domestic and industrial sewage. Results are expressed in terms of COD, BOD5, nitrite ion concentrations, bacterial counts, XAD-4-extractable compounds, and free amino acid concentrations. Ozone dosages of 6 to 12 mg/L were found to reduce levels of fecal bacteria, COD and nitrite ion concentrations significantly, to modify the nature and the concentration of XAD-4-extractable compounds, and to increase the concentration of free amino acids. (Author's abstract)
W88-02853

DEODORIZING OF SLUDGE SOLIDS BY ACTINOMYCETES,
Kyushu Univ., Fukuoka (Japan). Faculty of Agriculture.
A. Ishizaki, H. S. Sidhu, C. Lim, and W. Lim.
Agricultural and Biological Chemistry ABCHA, Vol. 51, No. 4, p 1155-1157, April 1987. 5 fig, 13 ref.

Descriptors: *Wastewater treatment, *Actinomycetes, *Isolation, *Deodorizing, *Sludge treatment, Cultures, Bacteria, Fungi, Sludge, Activated sludge.

Thirteen strains of Actinomycetes were isolated from soil in and around the factory premises of Ajinomoto Malaysia. Agar plates consisting of activated sludge extract (60% by vol.) nystatin (30 mg/liter), cycloheximide (30 mg/liter) and agar-agar (20 g/liter) were sterilized at 120 C for 30 min. One gram of soil was suspended in 10 ml of sterile water and shaken for 10 min. The soil suspension was spread on the surface of an agar plate, which was then incubated for 48 h at 50 C for monocolony isolation. The 13 strains isolated were used for the monoculture experiment to evaluate their deodorizing potential. Only two strains were deodorizing. The data suggest that living cells of bacteria and fungi became fewer while actinomycetes increased during the incubation. (Alexander-PTT)
W88-02886

DEVELOPMENT DOCUMENT FOR EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS FOR THE LEATHER TANNING AND FINISHING POINT SOURCE CATEGORY,
Environmental Protection Agency, Washington, DC. Effluent Guidelines Div.
D. F. Anderson.
Available from the National Technical Information Service, Springfield, VA 22161, as PB83-172593, A20 in paper copy, A01 in microfiche. EPA-440/1-82/016, November 1982. Final Report. 457 p, 6 fig, 79 tab, 70 ref, 9 append.

Descriptors: *Wastewater, *Wastewater composition, *Water pollution control, Wastewater analysis, Wastewater disposal, Water pollution control effects, Regulations, Legal aspects, Tannery wastes, Industrial wastes.

This document presents the findings of an extensive study of the leather tanning industry for the purpose of developing effluent limitations for existing point sources, standards of performance for new sources, and pretreatment standards of performance sources to implement the Clean Water Act. The study covers 158 facilities in SIC major group 3100 Leather and Leather products, and specifically subgroup SIC 3111, leather tanning and finishing. Effluent limitations guidelines are set forth for the degree of effluent reduction attainable through the application of the best practicable control technology currently available (BPT), and the best conventional technology pollutant control technology (BCT) which must be achieved by existing point sources by July 1, 1984. Standards of performance for new sources (NSPS) set forth the degree of effluent reduction that is achievable through the applications of the best available demonstrated control technology, processes, operating methods or other alternatives. Pretreatment standards for existing and new sources (PSES and PSNS) set forth the degree of effluent reduction that must be achieved in order to prevent the discharge of pollutants that pass through, interfere with, or are otherwise incompatible with the operations of POTWs. Supporting data, rationale, and methods for development of the effluent limitation guidelines and standards are contained in this document. (Author's abstract)
W88-02893

BIODEGRADABILITY TESTING OF INDUSTRIAL WASTES AND INTRACTABLE SUBSTANCES,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5B.
W88-02895

TREATMENT OF COAL CONVERSION WASTEWATER WITH THE POWDERED ACTIVATED CARBON-CONTACT STABILIZATION ACTIVATED SLUDGE PROCESS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
M. T. Suidan, M. Pirbazari, C. S. Gee, and M. A. Deady.
Available from the National Technical Information Service, Springfield, VA 22161, as DE82-008915, A03 in paper copy, A01 in microfiche. First Semi-annual Technical Progress Report for Period August 1, 1980-January 31, 1981. 21 p, 7 fig, 2 tab, 9 ref. Contract No. FG22-80PC30233.

Descriptors: *Activated sludge process, *Nitrification, *Activated carbon, *Organic carbon, *Clarification, Wastewater treatment, Industrial wastewater, Activated sludge, Ammonia, Nitrates, Nitrogen, Chemical oxygen demand, Denitrification, Biological wastewater treatment.

The effectiveness of the powdered activated carbon contact stabilization activated sludge process in the treatment of a coking wastewater was evaluated. The purpose of the contact tank is to provide sufficient time for adsorbable constituents of the coking wastewater to adsorb onto the powdered activated carbon. The liquor leaving the contact tank is then clarified with the concentrated underflow receiving treatment in the stabilization tank. After stabilization, the sludge is returned to the contact tank. The clarifier supernatant is then nitrified in an activated sludge-type nitrification process and the nitrified effluent is subsequently denitrified in an anoxic filter. The contact stabilization systems exhibited a decrease in COD and TOC removal efficiencies in response to increases in waste strength. Ammonia removal is averaging 76%. Further chemical analyses show that thiocyanate levels in the effluents from the contact and nitrification tanks have been steadily increasing and may be hindering the formation of nitrate nitrogen. Plans are under way to stabilize the operation of the system while maintaining the fed strength at 45%. (Geiger-PTT)
W88-02896

REMOVAL OF RADIUM-226 FROM URANIUM MINING EFFLUENTS: FINAL REPORT OF A JOINT GOVERNMENT-INDUSTRY PROGRAM,
Environmental Protection Service, Ottawa (Ontario).
D. W. Averill, D. Moffett, R. T. Webber, L. Whittle, and J. A. Wood.
Report EPS 3/HA/3, December 1984. 32 p, 12 fig, 7 tab, 12 ref.

Descriptors: *Wastewater treatment, *Uranium mining, *Industrial wastewater, *Radium, *Mine wastes, Filtration, Chemical precipitation, Coagulation, Clarification, Pilot plants, Barium chloride, Sludge, Dewatering.

Two treatment processes for removing radium-226 from uranium mine effluents were studied on the pilot plant scale. Both processes used barium-radium coprecipitation in series-connected stirred tank reactors. In one process coprecipitation was followed by chemical coagulation, mechanical flocculation, and solids/liquid separation in a clarifier. In the second process coprecipitation was followed directly by solids/liquid separation using chemically aided granular media filtration. The effluent contained 7.4-38.4 Bq/liter of total radium-226, of which 6.0-34.3 Bq/liter was dissolved. In the coprecipitation process a barium dosage of 16 mg/liter was optimum; most of the reaction occurred within the first 15 min. Problems encountered with the coprecipitation system included a drop in radium-226 removal with rising temperatures in wastewater and excess sulfate in the makeup water. On an average, dissolved radium-226 in the effluent was 0.19 Bq/liter (target 0.11 Bq/liter). Clarification did not achieve the target effluent quality. Filtration alternatives were explored. Direct filtration of the coprecipitation system effluent using a dual-media filter effluent bed achieved a radium-226 concentration of 0.07 Bq/liter in the final effluent. The filtration process sludge contained 1017 Bq/liter radium-226. (Cassar-PTT)
W88-02928

OPERATION AND MAINTENANCE COSTS FOR MUNICIPAL WASTEWATER FACILITIES IN CANADA - 1980,
Environmental Protection Service, Ottawa (Ontario).
S. A. Ross, M. G. Boivin, and D. L. Caverson.
Report EPS 5/UP/1, December 1984. 26 p, 4 fig, 14 tab, 6 ref, append.

Descriptors: *Wastewater treatment, *Costs, *Operating costs, Canada, Lagoons, Aerated lagoons, Facultative lagoons, Primary wastewater treatment, Secondary wastewater treatment, Chemical treatment, Biological wastewater treatment.

Average operation and maintenance costs for 1980 (in 1980 Canadian dollars per 1000 cu m treated) of Canadian wastewater treatment facilities larger than 1000 cu m per day were primary treatment, $44; secondary treatment, $54; aerated lagoons, $30; and facultative lagoons, $3. In general, for all levels of treatment except primary, the average cost per 1000 cu m of sewage treated decreases as the plant size increases. Generally, costs increase as the level of treatment progresses from lagoons to primary to secondary. Most plants surveyed were operating within 90-110% of design flow, lagoons accounting for 60% of the overloaded plants. Hydraulically underloaded plants averaged $60 per 1000 cu m treated versus $46 for hydraulically overloaded plants. Statistics are also presented for component costs such as personnel, electric power, sludge handling, and chemicals. With respect to BOD removal, primary plants had the highest unit costs, followed by secondary plants and lagoons. Suspended solids were cheapest to remove lagoons. Phosphorous removal costs were highest in aerated lagoons ($23 per 1000 cu m removed), followed by primary plants ($20), secondary plants ($16), and facultative lagoons ($2). Average costs per capita per year were primary, $9; secondary, $10; aerated lagoons, $8; and facultative lagoons, $1. (Cassar-PTT)
W88-02934

ALGAE AND PHOSPHORUS REMOVAL FROM SEWAGE LAGOON EFFLUENTS BY IN SITU CHEMICAL ADDITION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
M. J. Cullinane, and R. A. Shafer.
Available from the National Technical Information Service, Springfield, VA 22161as ADA-122035, A08 in paper copy, A01 in microfiche. Technical Report EL-82-6, September 1982. Final Report. 172 p, 58 fig, 38 tab, 63 ref, append.

Descriptors: *Wastewater treatment, *Lagoons, *Alum, *Chemical treatment, Sludge, Algae, Phosphorous removal, Ponds, Coagulation.

Alum was chosen as the coagulant in studies to improve the performance of wastewater stabilization lagoons at recreational sites. Three coagulant applications were done during the year's study, using a 14-ft boat with small outboard motor. The alum addition consistently produced effluents with phosphate concentrations below 1.0 mg per liter. Removal rates were as follows: BOD and COD about 80%; suspended solids, as high as 95%; and algae, as high as 95%. The alum treatment produced no visible adverse effects in lagoon performance or to vegetation. Sludge accumulations of 0.1 to 0.2 inches per chemical application were measured. Repeated application of alum did not produce significant increases in sludge thickness. The accumulated sludge was not subject to resuspension by gas generation. No long-term adverse effects on lagoon performance were predicted. Aluminum concentrations appeared to increase after repeated alum treatment. (Cassar-PTT)
W88-02937

BIOLOGICAL FLUIDIZED BED TREATMENT OF COKE PLANT WASTEWATER AND BLAST FURNACE SCRUBBER BLOWDOWN,
S. G. Nutt, and I. J. Marvan.
Report EPS 3/MM/1, Environmental Protection Service, Ottawa, Ontario. December 1984. 154 p, 33 fig, 50 tab, 115 ref.

Descriptors: *Wastewater treatment, *Chemical wastewater, *Fluidized beds, Biological wastewater treatment, Nitrification, Denitrification, Nitrogen removal, Coke effluents, Thiocyanates, Phenols, Organic compounds, Cyanide, Industrial wastewater.

A coupled biological fluidized bed system was tested for the treatment of coke plant wastewater and for a combined wastewater containing coke plant effluent and blast furnace scrubber blowdown. Complete nitrification and denitrification of undiluted coke plant wastewater was achieved at a hydraulic retention time of 16 hours. Removal efficiency was >90% nitrogen, filtered organic carbon, phenolic compounds, and thiocyanate. Treatment of the combined wastewater produced a higher effluent quality than the coke wastewater alone. A hydraulic retention time of only 4.5 hours was required to achieve these results. The effluent from the combined wastewater was analyzed for the organic priority pollutants and 24 nonpriority pollutants. Only di-n-butyl phthalate was identified at greater than 0.01 mg/liter despite the presence of trace organics in the untreated wastewater at levels of 15 mg/liter. Full-scale process design data and capital and operating costs estimates of both wastewater streams were developed. (Cassar-PTT)
W88-02938

OXIDATION DITCHES IN WASTEWATER TREATMENT,
M. G. Mandt, and B. A. Bell.
Ann Arbor Science, Ann Arbor, MI. 1982. 169 p.

Descriptors: *Wastewater treatment, *Oxidation ditches, *Activated sludge process, Ditches, Kinetics, Microbiology, Microorganisms, Bacteria, Sewage bacteria, Nutrient removal, Phosphorous, Nitrogen, Ammonia, Design criteria, Oxygen requirements, Oxygen transfer, Mixing, Hydraulics, Carrousel process, Aeration, Jet aeration, Orbal Process, Pasveer ditch, Maintenance, Sludge, Economic aspects.

Theoretical and practical information on oxidation ditches is presented for design and operation purposes. The oxidation ditch, a variant of the activated sludge process, is generally used in the extended aeration mode, e.g., long hydraulic and solids retention times and low organic loading rates. Topics included in this book are process kinetics (including microbiology), process modifications (including nutrient removal), nitrification and denitrification, oxygen requirements and transfer, mixing and hydraulics, proprietary processes (Carrousel, jet aeration channel, Orbal process, Pasveer-type plants, barrier ditches, and combined systems), operation and maintenance, design of continuous loop reactors, and economic considerations. (Cassar-PTT)
W88-02944

ACTIVATED SLUDGE PROCESS USED IN COAL CONVERSION (1976-FEB 1984): CITATIONS FROM THE U.S. DEPARTMENT OF ENERGY (EDB) DATA BASE.
National Technical Information Service, Springfield, VA.
Available from the National Technical Information Service, Springfield, VA 221161. PB84-861798, March 1984. 95 p.

Descriptors: *Wastewater treatment, *Bibliographies, *Activated sludge process, *Coal gasification, *Industrial wastewater, Biological wastewater treatment, Gasification, Wastewater composition, Activated carbon, Adsorption, Anaerobic digestion, Kinetics, Coal liquefaction, Fate of pollutants, Cyanides, Ammonia, Organic compounds, Sludge treatment, Sludge disposal, Zimpro process, Advanced wastewater treatment.

The treatment of coal conversion wastewaters by the activated sludge process is the topic of an annotated bibliography containing 104 citations. Subjects include anaerobic filters, aerated systems, fate of pollutants throughout the treatment process, sludge treatment and disposal, solvent extraction, ozonation, carbon adsorption, the Zimpro process, advanced wastewater treatment, wastewater composition, combined methods, and joint treatment with municipal sewage. (Cassar-PTT)
W88-02945

EVALUATION OF THE MISSION, SANTEE, AND TIJUANA HYDROLOGIC SUBAREAS FOR RECLAIMED-WATER USE, SAN DIEGO COUNTY, CALIFORNIA,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
J. AS. Izbicki.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4032, 1985. 99 p, 34 fig, 12 tab, 65 ref.

Descriptors: *Alluvial aquifers, *Water reuse, *California, *Water pollution effects, Groundwater, Impaired water quality, Seawater intrusion, Semiarid lands, Wastewater, Reclaimed water, San Diego County, Mission, Santee, Tijuana, San Luis Rey River, San Diego River, Tijuana River.

A study was made to determine the suitability of three small hydrologic subareas in San Diego County, California, for reuse of treated municipal wastewater (reclaimed water). Groundwater quality has been impacted by agricultural water use, changes in natural recharge patterns, seawater intrusion, and groundwater movement from surrounding marine sediments. Groundwater levels near land surface may limit artificial recharge of reclaimed water or may require pumping of groundwater from the aquifer prior to recharge with reclaimed water. Reclaimed water may be used for irrigated water in upland areas. (USGS)
W88-03051

WATER REUSE IN THE U.S. STEAM ELECTRIC POWER INDUSTRY--AN ASSESSMENT OF CURRENT PRACTICE AND POTENTIAL FOR FUTURE APPLICATIONS,
Dames and Moore, Bethesda, MD.
R. C. Tucker, and L. Breitstein.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-167657/AS. Price codes: A09 in paper copy, A01 in microfiche. Completion Report. January 1986. 175 p, 16 fig, 25 tab, 108 ref. Contract No. 14-08-0001-G1074. Project No. USGS G-1074.

Descriptors: *Steam electric generating industry, *Water reuse, *Water recycling, Water conservation, Wastewater cascading, Cooling tower blowdown, Ash sluice water, Makeup softening, Sidestream softening, Reverse osmosis, Evaporators, Dry cooling towers, Municipal effluents.

This study assesses the current and future potential for wastewater reuse and recycle by the steam electric generating industry in the United States. Fifty-three power plants employing one or more of the following reuse/recycle measures were identified by a literature search and interviews with reuse/recycle experts--cascading higher quality wastewaters to lower quality uses, recirculating ash sluice water, using cooling tower makeup or sidestream softening, treating and reclaiming wastewaters, using dry cooling systems, and using municipal effluents as plant intake water. Detailed case studies were performed on eight of the 53 plants surveyed. Technical, economic, environmental, and institutional data were collected and summarized for each reuse/recycle technology. Profiles of the steam electric generating industry were developed for use in estimating potential wastewater reuse/recycle through the year 2010. These profiles included combined generating capacities for several types of power stations with different plant systems. Potential water savings for nine water-short states and the entire nation were estimated by applying the technical and other data to the industry profiles for three reuse/recycle scenarios. Potential water savings were estimated to range from 30,000 to 840,000 acre-feet/year for the nine water-short states. (USGS)
W88-03145

DEVELOPMENT OF AN IMPROVED TEST FOR THE DETERMINATION OF BIOCHEMICAL OXYGEN DEMAND,
Catholic Univ. of America, Washington, DC.
For primary bibliographic entry see Field 5A.
W88-03149

IMPROVED EMITTER AND NETWORK SYSTEM FOR WASTEWATER REUSE IN DRIP IRRIGATION,
Hawaii Univ., Honolulu. Water Resources Research Center.
D. R. McDonald, L. S. Lau, I. P. Wu, and H. K. Gee.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-170370/AS. Price codes: A05 in paper copy, A01 in microfiche. Technical Report No. 163. July 1984. 87 p, 11 tab, 57 fig, Contract No. 14-34-0001-1464. Project No. USGS C10073-R.

Descriptors: *Drip irrigation, *Orifices, *Water reuse, *Wastewater reuse, *Hawaii, Water quality, Municipal wastewater, Emitter plugging, Mililani Wastewater Treatment Plant, Oahu.

The problem of emitter (orifice) plugging inherent in drip irrigation systems was investigated. Plugging not only reduces the effectiveness of this most water conservative method but also excludes the use of low quality waters unless first processed with costly water treatment. A problem-solution approach was used to develop simple emitters and a network system that would minimize plugging to acceptable levels. Tests using secondary treated municipal effluent from the Mililani Wastewater Treatment Plant on Oahu, Hawaii, consisted of numerous plugging experiments supplemented by theoretical and laboratory studies. Tests showed that plugging, up to 25% or less, can be controlled by using size emitters and passing the effluent through a stationary 40- and 80-mesh screen; critical-size emitters are 0.03 in for microjets and 0.019 in for monotubes; higher operating pressure further reduces plugging percentages; flexible 0.15 in slit orifices (at 15 psi) perform as well as the critical size rigid orifice but another round flexible orifice (rubber tube) was less successful; a multiple-inlet network design with critical-size emitters can minimize pressure and emitter flow variations along the drip laterals and was ideal for systems with large flow rates; and plugging was attributed to particles and fibers in the effluent. (USGS)
W88-03158

HEAVY METAL COMPOSITION OF TREATED MUNICIPAL WASTEWATER AND SLUDGE RESIDUES,
Savannah State Coll., GA. School of Science and Technology.
G. S. Ghuman.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-164191/AS. Price codes: A03 in paper copy, A01 in microfiche. Report No. ERC 05-85. Environmental Resources Center, Georgia Institute of Technology, Atlanta. August 1985. 19 p, 1 tab, 1 fig, 12 ref. Project No. USGS G-900-04.

Descriptors: *Groundwater contamination, *Leaching, *Sludge, *Biodegradation, *Heavy metals, *Wastewater treatment, Water quality, Particulate matter.

A study was conducted on the City of Savannah's Water Pollution Control Plant to determine the efficiency of wastewater treatment in the removal of heavy metals. Four periodic samples of influent water, effluent water and sewage sludge were collected in October, December, 84 and March, June, 85 and were analyzed for the concentrations of Mn, Zn, Cd, Cu, Ni and Cr. The concentrations of dissolved heavy metals were slightly greater in the treated effluent water than in the influent water. Separation of sludge was effective in the overall removal of heavy metals from the wastewater. Activated sludge components of effluent water also had high concentrations of heavy metals. Metals should be fully removed from the discharged water. Among the heavy metals, the total concentrations of Zn, Cu and Ni in the effluent water (both the aqueous and the sludge phases) decreased, which indicated a material balance of zero for these metals when removal in the separated sludge is considered. The higher total concentrations of Mn, Cd and Cr in the effluent water as compared to the influent water may be possible due to the influent water sampling not being truly

representative. Leaching study in PVC columns packed with sludge ash (pH 10.4) was conducted using de-ionized water, lagoon water, and acetic acid 5000 ppm (pH 5.0) as the leaching solutions. All leachates contained very low amounts of heavy metals. Incineration of limed sewage sludge into ash appears to be an efficient method of disposal. High concentrations of heavy metals as insoluble oxides in the sludge ash may prove to be a commercial source in the future for chemical separation. (Ghuman-Savannah St. Coll.)
W88-03165

INFORMATIONAL/EDUCATIONAL APPROACHES TO PUBLIC ATTITUDES ON POTABLE REUSE OF WASTEWATER; RESEARCH STUDY REPORT; PROGRAM GUIDE FOR MUNICIPAL WATER SYSTEM ADMINISTRATORS,
Denver Research Inst., CO.
L. C. Lohman, and J. G. Milliken.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-167624/AS. Price codes: A07 in paper copy, A01 in microfiche. Final Report. August 1985. 66 p, 23 tab, 23 ref, 6 append. Contract No. USGS 14-34-0001-1475.

Descriptors: *Water reuse, *Potable reuse, *Wastewater renovation, *Public attitudes, *Survey research, Recycling, Reclamation, Public opinion, Public acceptance, Education, Public information.

The reported research measured the degree of public awareness about potable wastewater reuse and analyzed the effects of information/education measures on public understanding and acceptance of potable use of wastewater that has been reclaimed to drinking water standards. The study was conducted over a 3-year period with customers of the Denver Water Department. Denver is likely to be the first U.S. metropolitan area to directly recycle wastewater after advanced treatment for water supply augmentation, probably in the next 20 years. Two random sample surveys were conducted of users of water supplied by the Denver Water Department (in 1982 and 1985). The surveys queried respondents on general attitudes about water, sources of information, acceptance of various types of water reuse, and socio-demographics. A 72-member experimental panel was drawn from the 1982 respondents and subjected to various forms of educational treatments to measure shifts in attitudes toward wastewater reuse. The analysis and survey results are incorporated into a research report and a program guide for municipal water system administrators for use in U.S. communities which will need to educate and inform their customers about reuse. (Lohman-Denver Res. Inst.)
W88-03168

REDUCTIVE DECHLORINATION OF TOXIC CHLOROCARBONS,
Kentucky Water Resources Research Inst., Lexington.
K. G. Taylor.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-170404/AS. Price codes: A02 in paper copy, A01 in microfiche. Research Report No. 161. December 1985. 8 p, 1 fig, 8 ref. Contract No. 14-08-0001-G-908. Project No. USGS G-908-06 (A101-KY).

Descriptors: *Wastewater treatment, *Catalysts, *Chlorinated hydrocarbons, *Chemical wastes, Chemical reduction, Dechlorination, Polychlorobiphenyls, Polychlorodibenzodioxin.

To detoxify chlorinated hydrocarbons, sodium hydride based reducing agents were prepared by the method of Caubere. Reagents were prepared containing nickel, iron and zinc metals. All were effective in dechlorinating 1,3-dichlorobenzene, 4-methoxy-chlorobenzene, and arochlor 1254. Most work focused on nickel based reagents, the most active. The nickel-based reducing agent used in THF at 65 C reduced to 200 ppm 1,3-dichlorobenzene (to benzene) and arochlor 1254 (to biphenyl) to below 0.2 ppm in less than 15 minutes. A two stage reduction reduced arochlor 1254 to below a detectable level as determined by gas chromatography using f.i.d. detector. Using 1,3-dichlorbenzene as a model showed that the first halogen is reduced more rapidly; 4-methoxy-chlorobenzene was reduced to methoxybenzene less efficiently, but polychlorinated ethers are expected to react rapidly. The presence of water reduced the activity of the Ni catalyst, reducing the rate of dechlorination. Two staged reductions of 1,3-dichlorobenzene using iron and zinc based catalysts at 65 C, hr per stage, gave more than 99% reduction. Use of the Ni based reagent catalyst with hydrogen at 2 atm as reducing agent converted 1,3-dichlorobenzene to benzene; rated data have yet to be taken. The overall results provide a base for additional pilot studies using iron and zinc based reagents with the aim of increasing the reagent activity. The results are expected to give a clearer direction for a comprehensive study. (Huffsey-U. of KY, WRRI)
W88-03177

BIODEGRADATION OF HAZARDOUS CHEMICAL WASTES,
Louisiana State Univ. Medical Center, New Orleans.
W. Pelon, and M. L. Murray.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-170446/AS. Price codes: A02 in paper copy, A01 in microfiche. Louisiana Water Resources Research Institute Project Completion Report. 1985. 9 p. Contract No. 14-08-0001-G-909. Project No. USGS G909-04.

Descriptors: *Wastewater treatment, *Biodegradation, *Toxic wastes, *Aquatic microbiology, Water quality, Groundwater quality, Pesticide residues.

Under natural conditions, the biodegradation of hazardous organic chemical wastes is often a slow process. Although appropriate microbial populations are present where such wastes exist, their biodegrading activities are often hampered as the result of low population densities, population pressures, and also by the presence of alternate carbon sources that are preferentially metabolized. This study involves the enhanced biodegradation of hazardous organic chemical wastes through the use of a 'synthesized' mixed microbial population that has attained a steady state of growth while using hazardous organics present in water samples as their sole source of carbon, biodegrading them to where recognized assay systems can no longer detect toxicity and/or mutagenicity. Individual members within such a population will be isolated, propagated under optimal conditions, then mixed to form a dense synthetic population that would permit more rapid biodegradation by the presence of sheer numbers. Pond water from the Cleve Reber waste dump site was initially selected, but was found to be neither toxic nor mutagenic, an observation that was subsequently confirmed by the US EPA. Recently a second sample of groundwater, obtained from the Petro Processor Waste Dump site in north Baton Rouge, was assayed and found to be both mutagenic and toxic. Biodegradation studies are being initiated using the water as the substrate and soil samples from the site as the inoculum. (Pelon-LA. St. Med. Cr.)
W88-03180

TOXIC AND HAZARDOUS WASTES.
Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. 639 p. Edited by Gregory D. Boardman.

Descriptors: *Wastewater treatment, *Waste disposal, *Wastewater management, *Water pollution effects, *Waste management, Wastes, Wastewater, Regulations, Underground storage, Sludge, Biological wastewater treatment, Hazardous materials, Landfills, Industrial wastewater, Industrial wastes, Sludge drying, Groundwater, Path of pollutants, Fate of pollutants, Water pollution, Groundwater pollution, Chemical wastewater treatment.

The proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference on toxic and hazardous wastes are presented. The problems associated with leaking underground storage tanks, industrial wastes, groundwater pollution, groundwater contaminant transport, and toxic and hazardous materials are discussed. Wastewater treatment and disposal methods falling into the categories of biological treatment, solidification, stabilization, pretreatment, resource recovery, land application, sludge management, and physicochemical treatment are summarized. The conference gave representatives of industries, consulting companies, regulatory agencies, and academia a chance to exchange ideas and accomplishments in order to decrease the effects on the environment of industrial and/or hazardous wastes. (See W88-03224 thru W88-03271) (Wood-PTT)
W88-03223

DEVELOPMENT AND PERFORMANCE OF A PILOT-SCALE, ACTIVATED SLUDGE FACILITY FOR THE TREATMENT OF A TEXTILE WASTEWATER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
B. P. Gayle, G. D. Boardman, and R. B. Reneau.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 44-57, 1 fig, 4 tab, 5 ref.

Descriptors: *Wastewater treatment, *Textile mill wastes, *Activated sludge process, *Industrial wastewater, Wastewater, Sludge, Pilot plants, Land disposal, Irrigation, Hydrogen ion concentration, Pretreatment of wastewater, Nitrogen, Ammonia stripping, Ammonia.

A pilot-scale, activated sludge facility which was constructed as part of a land application field study to evaluate pretreatment of textile wastewater prior to land treatment by slow rate irrigation, is discussed. Previous bench-scale experiments showed that during activated sludge treatment, the pH of the reactor mixed liquor rose above pH 8 and ammonia volatilized. Characterization of the wastewater showed that nitrogen was the limiting component in determining irrigation land area requirements which suggested that the field study should include pretreatment to reduce nitrogen prior to land application. A pilot-scale pretreatment facility incorporates innovative and low-cost materials. Operation of the facility includes the optimization of organic nitrogen conversion to ammonia to facilitate nitrogen removal or recovery using ammonia stripping, the determination of biokinetic coefficients for biomass yield, biomass decay, maximum substrate utilization rate, and substrate concentration. The problems encountered, such as changing wastewater characteristics and temperature variations which made determination of the biokinetic constants difficult, are detailed. (See also W88-03223) (Wood-PTT)
W88-03227

IRON AND MANGANESE REMOVAL USING A ROTATING BIOLOGICAL CONTACTOR,
CH2M Hill, Milwaukee, WI.
E. K. Russell, and J. E. Alleman.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 58-73, 19 fig, 3 tab, 18 ref.

Descriptors: *Wastewater treatment, *Rotating biological contactors, *Heavy metals, *Iron, *Manganese, *Biological wastewater treatment, Metals, Biofilm, Wastewater, Chemical oxygen demand, Metal deposition, Biomass.

The removal of two heavy metals, iron and manganese, within a rotating biological contactor (RBC) wastewater treatment system is described. The effects of these metals on the RBC process, in addition to their accumulation within the biofilm, were studied. If the RBC biofilms become coated with the metals, decreased transfer of nutrients, waste products and gases across the biofilm surface would result. Iron and manganese, both of which are readily oxidized and deposited, could cause a

decrease in treatment efficiency accompanied by an increase in the weight load on the shaft and biofilm attachment media. The RBC process was efficient in removing the metal concentrations applied with very little simultaneous decline in soluble COD removal; but that the weight gain experienced by the RBC unit from the metal deposition within the biomass was detrimental to the normal operation. (See also W88-03223) (Wood-PTT)
W88-03228

EFFECTS OF EXTENDED IDLE PERIODS ON HAZARDOUS WASTE BIOTREATMENT,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
A. S. Weber, M. R. Matsumoto, J. G. Goeddertz, and A. J. Rabideau.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 74-93, 8 fig, 2 tab, 6 ref.

Descriptors: *Wastewater treatment, *Hazardous materials, *Groundwater pollution, *Intermittent wastewater treatment, *Biological wastewater treatment, Groundwater, Wastewater, Leachates, Economic aspects, New York, Chemical oxygen demand, Activated carbon.

An experimental study assessed the technical feasibility of using biological processes for treating hazardous waste when extended periods of inoperation are imposed on operation protocol. The process was developed to provide a cost effective treatment or leachates and contaminated groundwater from a former hazardous waste handling facility in New York, where waste collection rates were expected to be low and, therefore, require intermittent process operation. It proved to be possible to achieve a significant removal of waste pollutants using intermittent biological treatment although the rate of COD removal was adversely affected by decreases in operation frequency and decreased operating temperatures. However, if reaction periods are extended, all biodegradable COD removal can be accomplished in bioreactors using long lag periods. Addition of powdered activated carbon was tested and hypothesized to be advantageous in reducing aeration times for conditions of low temperature and extended lag periods. (See also W88-03223) (Wood-PTT)
W88-03229

EFFECTS OF BIOAUGMENTATION ON HAZARDOUS WASTE TREATMENT,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
J. R. Hartman, C. R. Lange, M. R. Matsumoto, and A. S. Weber.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 94-115, 3 fig, 4 tab, 67 ref.

Descriptors: *Wastewater treatment, *Bacteria, *Bioaugmentation, *Biological wastewater treatment, *Chlorinated hydrocarbons, Hazardous materials, Biodegradation, Wastewater, Chemical oxygen demand.

Recently several bacterial strains were discovered and isolated from hazardous waste landfills. Because these bacteria have developed the ability to metabolize certain persistent organics as sole carbon and energy sources, experiments involving the addition of these bacteria to waste treatment facilities to improve the biodegradation efficiency of persistent organic compounds were performed. Based on the data collected to compare the publicly owned treatment works (POTW) and commercial hazardous waste treatment, storage, and disposal facility sequencing batch reactors (TSDF SBR), approximately 75% of the influent COD was removed. Because the supplemental bacteria were known to degrade chlorinated organics, 4-chlorobenzoic acid and 2,4-dichlorophenol were added to the studied waste. Although little or no improvement in overall treatment was observed on the basis of COD or TOC removal, supplementation appeared to decrease the acclimation time needed for biodegradation of chlorinated organics. (See also W88-03223) (Wood-PTT)
W88-03230

ANAEROBIC UPFLOW SLUDGE BED FILTER REACTOR TREATING DILUTE CARBOHYDRATE WASTEWATERS,
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
S. S. Gorur, S. R. Guiot, K. J. Kennedy, and R. L. Droste.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 116-130, 9 fig, 3 tab, 14 ref.

Descriptors: *Wastewater treatment, *Anaerobic upflow sludge bed filter reactor, *Dilute wastewater, *Sludge digestion, *Carbohydrates, Sludge, Anaerobic digestion, Biomass, Chemical oxygen demand, Hydraulic retention time, Bacteria, Methane bacteria.

The upflow sludge bed-filter (UBF) reactor treats medium strength synthetic wastes successfully. The ability to treat dilute strength wastes was evaluated using dilute strength soluble synthetic wastewater. The design characteristics of UBF reactors provided sufficient biomass retention to achieve 95% efficiency based on soluble COD removal down to a hydraulic retention time (HRT) of 3 hours. Below HRT of 2 hours, sufficiently long solids retention time could not be maintained resulting in preferential washout of methanogenic bacteria and deterioration in reactor performance. Batch measurements of specific acetoclastic activity for HRT less than 3 hours showed a decrease in the proportion of methanogens in the biomass and high nitrogen concentration in the off gas was measured. This was consistent with other biomass retaining reactors treating dilute strength wastes. The encouraging results obtained in treating dilute synthetic wastewater of 300 mg COD/L at an HRT of 3 hours suggest that studies with UBF reactors for very dilute wastewaters are warranted. (See also W88-03223) (Wood-PTT)
W88-03231

DESIGN OF A FULL SCALE ANAEROBIC FACILITY FOR TREATMENT OF FOOD PROCESSING WASTEWATER,
Commonwealth Engineering and Technology, Inc., Harrisburg, PA.
T. E. Whittle, and K. E. Bodine.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 131-141, 1 fig, 4 tab, 3 ref.

Descriptors: *Wastewater treatment, *Food-processing wastes, *Industrial wastewater, *Design standards, *Anaerobic wastewater treatment, *Wastewater facilities, Biological oxygen demand, Chemical oxygen demand, Anaerobic digestion, Food-processing industry, Pennsylvania, Organic loading, Design criteria.

Wastewater from the vegetable and fruit processing facilities of Hanover Brands, Inc. in Pennsylvania is screened, collected in a wet well, pH adjusted, and discharged into the municipal wastewater treatment plant contributing a major component of the organic loading to the municipal facility. Finding treatment alternatives involved the design of an anaerobic reactor which was tested on a pilot-plant scale. Design of the full-scale anaerobic reactor was begun following less than two years of pilot-plant testing. Since that time, increased efficiency was realized with higher BOD and COD loadings. Following the construction of the full-scale unit, several years will pass before the design loadings are achieved allowing ample time for evaluation of the performance of the single unit and determination of the need for subsequent units. (See also W88-03223) (Wood-PTT)
W88-03232

MODIFYING ION-EXCHANGE RESIN COMPOSITIONS FOR SELECTIVE REMOVAL OF POTENTIALLY TOXIC HEXAVALENT CHROMIUM SPECIES,
Lehigh Univ., Bethlehem, PA. Fritz Engineering Lab.
A. K. Sengupta.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 142-156, 9 fig, 12 ref.

Descriptors: *Wastewater treatment, *Ion exchange, *Resins, *Chromium, Chromates, Heavy metals, Ions, Anions, Separation techniques, Ion separation, Amines, Hazardous material, Selectivity.

Properties of ion-exchange resins are very important for the selective removal of an ion in the presence of other competing ions. The effects of resin matrix and resin functionality on chromate selectivity are presented showing how variation in composition can dictate the viability of the ion-exchange separation processes. Increased hydrophobicity of the resin matrix and a longer alkyl group in the amine functionality, greatly improve the chromate selectivity of the ion-exchange resins. Besides functionality and matrix, other properties, such as crosslinking, porosity, and total capacity are also important and require detailed study. The use of modified resin composition is not necessarily limited to chromate recovery processes; the results obtained can be applied to other selective ion-removal processes. (See also W88-03223) (Wood-PTT)
W88-03233

BIOLOGICAL TREATMENT OF SIMULATED LANDFILL LEACHATE CONTAINING CHLORDANE,
Memphis State Univ., TN. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W88-03234

TREATMENT OF A LANDFILL LEACHATE IN POWDERED ACTIVATED CARBON ENHANCED SEQUENCING BATCH BIOREACTORS,
Occidental Chemical Corp., Grand Island, NY. Research Center.
For primary bibliographic entry see Field 5G.
W88-03235

LOW TEMPERATURE THERMAL STRIPPING OF VOLATILE COMPOUNDS – A FIELD DEMONSTRATION PROJECT,
Weston (Roy F.), Inc., West Chester, PA.
For primary bibliographic entry see Field 5E.
W88-03237

SOLIDIFICATION/STABILIZATION OF CONTAMINATED DREDGED MATERIAL,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
J. M. Betteker, J. H. Sherrard, and D. D. Ludwig.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 253-273, 9 fig, 1 tab, 16 ref.

Descriptors: *Dredging, *Waste disposal, *Solidification, *Stabilization, *Wastewater treatment, *Hazardous materials, Bottom sediments, Industrial wastes, Chemical properties, Physical properties, Pozzolans, Cements, Additives, Concrete additives, Leaching, Leachates, Heavy metals, Organic compounds, Metals, Polychlorinated biphenyls.

Because the management of bottom sediments containing toxic substances has become increasingly important, the technical feasibility of applying solidification/stabilization technology to contaminated dredged material was investigated. Laboratory-

scale applications of selected solidification/stabilization processes to a highly contaminated industrial canal sediment and an evaluation of the stabilized/solidified products on the basis of physical and chemical properties were performed. It was concluded that physical stabilization of the contaminated dredged material is a viable treatment option since all proprietary pozzolanic additive and Portland cement mixtures applied formed a solidified sediment. No single process formulation proved to be effective in providing chemical stabilization for all contaminants as a group, although solidification did provide a significant amount of chemical stabilization. The results of serial batch leaching tests showed that the aqueous phase concentrations were lower than sediment phase concentrations by as much as three to five orders of magnitude and in many cases contaminants were completely immobilized for the contaminants analyzed. Specific solidification additives were evaluated for various metal and organic contaminants. (See also W88-03223) (Wood-PTT)
W88-03240

TREATABILITY STUDY AND DESIGN OF A TREATMENT PLANT FOR LEACHATE GENERATED FROM A COAL ASH DISPOSAL SITE,
GAI Consultants, Inc., Monroeville, PA.
P. Yodnane, D. W. Okorn, and R. J. Williams.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 274-290, 3 fig, 8 tab, 5 ref.

Descriptors: *Wastewater treatment, *Coal ash, *Leachates, *Wastewater treatment facilities, *Industrial wastes, *Industrial wastewater, West Virginia, Disposal sites, Water quality control, Runoff, Design standards, Design criteria, Waste disposal, Water quality.

The results of a short-term treatability study for the leachate and contaminated runoff at the Twenty-Five-Year Ash Disposal Facility in West Virginia which is involved in the dry disposal of coal ash are summarized. Appropriate design parameters for an additional new treatment plant, including a water quality data review, leachate quality simulation, wastewater flow estimation, batch treatment test and continuous flow treatment and flocculation test, were evaluated. Results from the tests show that the leachate quality expected from the proposed site will be similar to the leachate quality of existing sites. Specific design parameters based on the leachate quality and quantity data are presented. (See also W88-03223) (Wood-PTT)
W88-03241

SLUDGE FLOCCULATION AT AN INDUSTRIAL WASTE FACILITY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
J. T. Novak, and C. W. Randall.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 322-330, 6 fig, 5 ref.

Descriptors: *Wastewater treatment, *Sludge flocculation, *Flocculation, *Industrial wastewater, Coagulation theory, Industrial wastes, Sludge, Activated sludge, Coagulation, Colloids, Polymers, Sludge digestion,Nitrogen, Proteins.

An industrial waste treatment system at a plant producing cellulose acetate resin, yarn, and tow experienced frequent disruptions due either to poor settling sludge or poor flocculation. Investigations were carried out which resulted in a considerable improvement in sludge behavior based on the coagulation theory which suggests that floc formation can be described as a system of anionic colloids being coagulated by naturally occurring anionic polymers. The data collected indicate that the quantity of biopolymer is rarely a problem, but that polymer binding is critical to proper flocculation. It was determined that it is important to have a sufficient amount of nitrogen present in order for polymers to bind since the binding ability appears to be directly related to the protein content of the biopolymer and a sufficient quantity of divalent cations available to achieve proper polymer to colloid attachment. (See also W88-03223) (Wood-PTT)
W88-03244

UTILIZATION OF AN ANAEROBIC BIOTOWER IN THE TREATMENT AND RECYCLE OF ROTOGRAVURE PRINTING PROCESS WASTEWATERS,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
D. W. Weeter, and J. McGowan.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 331-339, 2 fig, 3 tab, 4 ref.

Descriptors: *Wastewater treatment, *Anaerobic biotower, *Biological wastewater treatment, *Industrial wastewater, *Printing industry wastes, Distillation, Filtration, Chlorination, Clarification, Wastewater, Wastewater renovation, Water reuse, Tennessee, Solvents.

The development of a cost-effective biological/physical treatment process for rotogravure printing process wastewaters for Plus Mark located in Tennessee is described. Gaseous solvents evolving from the printing presses are collected in ducts and adsorbed via activated carbon. The solvents are desorbed by steam and the solvent-bearing water from decant is then distilled and recovered for reuse. The distillation bottoms containing ethyl acetate, ethanol, acetic acid and toluene were treated in an anaerobic biotower. The process design consists of an underground tank, anaerobic tower, clarifier, sand filter, activated carbon adsorption tank, chlorinator and retention pond. The system performance is discussed. (See also W88-03223) (Wood-PTT)
W88-03245

ECONOMICAL PRETREATMENT FOR COLOR REMOVAL FROM TEXTILE DYE WASTES,
G. R. Brower, and G. D. Reed.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 340-347, 2 fig, 3 tab, 13 ref.

Descriptors: *Wastewater treatment, *Color removal, *Textile mill wastes, *Industrial wastewater, *Dye wastes, Pretreatment of wastes, Pretreatment of water, Oxidation process, Coagulation, Economic aspects, Sludge, Municipal wastewater treatment, Color, Costs, Industrial wastes, Effluents.

Small quantities of dye in a waste often contribute to the presence of color in very large quantities of wastewater; often the dye is affected very little in domestic wastewater treatment processes. The dye passes through the biological treatment process essentially unaltered, producing a colored effluent. It is not practical for a municipality to remove the dye at their treatment facility since the quantity of waste is so large. However, if the dye is removed by precipitation at the industrial facility, the resulting costs of sludge handling could be quite large. Treatability studies were, therefore, conducted to determine of the colors of two textile wastes could be destroyed by oxidation or removed by coagulation and if the dye, once removed by coagulation, would remain insoluble even after prolonged exposure to sewage making it possible for the solids to be removed by the domestic treatment plant and relieving the industry from sludge handling operations. Wastes from both industrial sources formed stable sludges when mixed with raw municipal sewage and no measurable sewage color change was observed. Schematic diagrams of the wastewater pretreatment systems and costs are presented. (See also W88-03223) (Wood-PTT)
W88-03246

ACTIVATED SLUDGE TREATMENT AND SALT MARSH POLISHING FOR SEAFOOD PROCESSING WASTEWATER: AN EXPERIMENTAL INVESTIGATION,
Lehigh Univ., Bethlehem, PA. Center for Marine and Environmental Studies.
V. G. Guida, and I. J. Kugelman.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 376-390, 4 fig, 3 tab, 26 ref.

Descriptors: *Wastewater treatment, *Land disposal, *Water quality control, *Food-processing wastewater, *Activated sludge process, Salt marshes, Water quality, Wastewater, Clams, Biological oxygen demand, Kjeldahl nitrogen, Suspended solids, Water pollution control, New Jersey.

The discharge of seafood processing wastes, particularly clam processing wastewater, into tidal waters contributes to chronic cultural eutrophication in estuaries. Clam processing wastewater has levels of chemical and biochemical oxygen demands (COD and BOD) total Kjeldahl nitrogen (TKN) that surpass those of raw domestic sewage. Current technology which calls for treatment in an aerated lagoon does not reduce the BOD sufficiently to consistently meet the strict New Jersey standards which require 95% BOD removal from industrial wastes. Therefore, the efficacy of 'polishing' clam water that was treated aerobically in a salt marsh to further reduce oxygen demand and nutrient concentrations in the wastewater was investigated. Raw clam processing wastewater from an industrial facility in New Jersey was subjected to extended aeration activated sludge treatment operated with two different solids retention times. The effluent was applied to boxes in which salt marsh grasses were planted and which were flooded with measured volumes of tidewater on a schedule simulating that of local natural marshes during the same seasons. The tidal water was drained and analyzed for BOD, total suspended solids, TKN, and orthophosphate and the results were compared with the controls, runoff from marshes receiving no wastewater. The most substantial differences were in total phosphorus concentration in summer and total nitrogen and total phosphorus in winter. (See also W88-03223) (Wood-PTT)
W88-03250

START-UP OPTIMIZATION OF THE MECHANICAL AND CHEMICAL PARAMETERS INFLUENCING THE DEWATERING PERFORMANCE OF A GRAVITY BELT FILTER PRESS OPERATION,
Exxon Chemical Americas, Houston, TX.
G. O. Barraclough, D. J. Brown, S. A. Lordo, and H. J. Santicola.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 391-395, 1 fig, 8 tab.

Descriptors: *Wastewater treatment, *Gravity Belt Filter Press, *Sludge drying, *Dewatering, *Sludge, Wastewater facilities, Sludge thickening, Case studies, Sludge cake, Conditioning, Chemical treatment, Mechanical control.

A recent gravity belt filter start-up is reviewed and the laboratory correlation studies conducted at a major Gulf Coast Refinery's wastewater treatment facility are described. The installation of the twin belt 2.2 meter press was designed to remove water from their dewatered solids to be landfarmed. Prior to the belt press operation, the low solids stream was pumped to a retention pond, which required periodic cleaning and subsequent disposal. Because the installation was new, the influence of the various chemical and mechanical parameters that directly affected the optimum performance of the gravity belt filter press operation required definition. The chemical parameters isolated and optimized included: (1) chemical conditioning time (addition point), (2) conditioning chemical solution concentration, and (3) conditioning chemical fee-

drate. Included in the mechanical parameters requiring optimization were: (1) mixing drum speed, (2) sludge charge rate, and (3) belt speed. The influences of each variable on the solids recovery and final cake solids were measured independently. (See also W88-03223) (Wood-PTT)
W88-03251

TWO FACTORY APPLICATIONS OF A MICROWAVE SYSTEM PERCENT SOLIDS ANALYZER AND OVEN,
Merck and Co., Elkton, VA. Merck Chemical Mfg. Div.
J. B. Reeves, and S. B. Shank.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 396-399.

Descriptors: *Wastewater treatment, *Microwave ovens, *Wastewater facilities, *Activated sludge, *Industrial wastes, Sludge, Sludge drying, Microwave technology, Solids.

Two successful applications of a microwave system percent solids analyzer and oven on routine activated sludge system samples at a large pharmaceutical manufacturing plant are summarized. The first application of the Model AVC-80 (Automatic Volatility Computer) was on samples of dewatered waste activated sludge from a belt filter press which were subjected to the analyzer for rapid analysis of their percent solids in order to allow operators to gain immediate optimum press performance rather than guessing the percent solids or waiting for laboratory results. Because all wasted sludge is incinerated, maximum percent solids from the belt filter press is economically desired. Other treatment system samples, particularly polymer solutions and clarifier and digestor sludges, were also tested by the analyzer which performed reliably and without need for maintenance even in this severe environment with numerous operators. The second application was in the central Quality Control laboratory using an automated Model MSD-81 oven (Microwave Drying/Digestion System). The oven's microwave drying had the advantage of speed since it required only a few minutes rather than the 2-5 hours needed by a conventional oven because of its uniform heating of the water throughout the sample. The microwave drying was also selective due to rapid volatilization of water molecules without many other volatile components. In addition, the oven was able to dry samples analytically to less than 0.1 milligrams water in a few minutes, which was not possible using conventional microwave ovens because of problems with reflected energy. (See also W88-03223) (Wood-PTT)
W88-03252

POLYMER PERFORMANCE IN SLUDGE CONDITIONING,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
N. Bandak, and J. T. Novak.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 400-408, 7 fig, 1 ref.

Descriptors: *Wastewater treatment, *Sludge conditioning, *Polymers, *Chemical treatment, *Dewatering, Sludge, Drying, Sludge drying, Mixing, Coagulation, Chemical coagulation, Anaerobic digestion.

In order to aid in the disposal of sludges, dewatering is practiced to reduce sludge volumes and improve handling properties. Synthetic polymers have been used recently as conditioning chemicals which are added during dewatering to increase the rate of the operation. The selection of the optimum polymer dose depends on the nature both of the sludge and the polymer used, as well as on the characteristics of the dewatering equipment including mixing intensity. Some of the effects of mixing on polymer performance in sludge conditioning were evaluated. Primary particle breakup involving the fragmentation of sludge particles upon mixing and polymer disruption involving the reduction in size and/or effectiveness of the polymer due to fracture or folding during intense mixing were considered in experiments using lime and alum sludges from water treatment plants and anaerobically digested sludge from a wastewater treatment plant. High and medium-molecular weight polymers served as coagulants. In general it was found that the effects of mixing that result in increases in polymer dose requirements appear to be due to the breakup of primary sludge particles. Polymer fracture or folding accounted for little of the increased polymer dose for common dewatering processes. (See also W88-03223) (Wood-PTT)
W88-03253

STRATEGIES AND CHOICES IN PENNSYLVANIA'S HAZARDOUS WASTE FACILITIES PLAN,
Environmental Resources Management, Inc., West Chester, PA.
P. L. Buckingham, R. J. Buchanan, and M. D. LaGrega.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 489-501, 1 fig, 1 tab, 2 ref.

Descriptors: *Wastewater treatment, *Wastewater facilities, *Legal aspects, *Regulations, *Hazardous materials, *Pennsylvania, State jurisdiction, Waste management, Wastes, Planning, Wastewater management.

The contents of the Pennsylvania Hazardous Waste Facilities Plan and how it was developed are discussed and an evaluation of the Plan presented. The Plan was designed as the blue print for managing hazardous waste in Pennsylvania and as such: (1) provides information about the amounts and types of hazardous wastes generated in the Commonwealth, (2) outlines the types of modern technologies that will be needed to treat and dispose of that waste, (3) outlines basic hazardous waste management policies for the Commonwealth, (4) presents siting criteria to be met by all new facilities, (5) presents a strategy to encourage source reduction, and (6) identifies the hazardous waste treatment and disposal facilities that are needed to provide for the proper management of hazardous wastes generated in Pennsylvania. The procedures for hazardous waste facility siting, featuring public participation and state override of local powers, were reviewed. (See also W88-03223) (Wood-PTT)
W88-03261

HAZARDOUS WASTE MINIMIZATION PLANNING AT THE ARMY MATERIEL COMMAND (AMC),
Army Materiel Development and Readiness Command, Alexandria, VA.
J. J. McCarthy, R. E. Newsome, and W. N. Hasselkus.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 502-514, 7 tab, 9 ref.

Descriptors: *Waste management, *Waste minimization, *Hazardous materials, *REgulations, Waste disposal, US Army, Toxicity, Waste treatment, Waste recovery, Recycling, Material substitution.

In September 1985 the Army Materiel Command (AMC) engineer was directed to develop a comprehensive hazardous waste (HW) plan for the AMC and in November a policy was issued calling for a reduction in HW volume and toxicity in a practical and economical manner, and stressing the importance of addressing HW minimization in all AMC support activities. These two events centralized and prioritized AMC's present HW minimization effort. The Hazardous Waste Minimization (HAZMIN) Plan, finalized in March 1986, outlined the actions that AMC will take to reduce its HW generation and how it will manage those wastes that are formed. The suggested HW reduction methods are presented in order of their priority: (1) hazardous material control, (2) delisting, (3) material substitution, (4) process change, (5) recycling, reusing, or reselling, (6) treatment, (7) destruction by burning, open detonation, thermal destruction or incineration, and (8) disposal without or with sufficient treatment. The HW reduction methods favor managing the waste before rather than after generation which, of necessity, involves participation by departments that are not primarily concerned with HW and that do not consider it a high priority for mission accomplishment. AMC HAZMIN Plan milestones were described and comments were made on future installation plans. (See also W88-03223) (Wood-PTT)
W88-03262

POLYCHLORINATED BIPHENYL (PCB) DECONTAMINATION OF TRANSFORMERS,
Envirocon Systems, Inc., King of Prussia, PA.
I. Webber.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 526-544, 5 fig, 9 ref.

Descriptors: *Polychlorinated biphenyls, *Transformers, *Decontamination, *Waste treatment, *Fate of pollutants, Cleanup, Detoxification, Vapor cleaning method, Electrical equipment, Cleaning, Diffusion coefficient, Leaching.

Because of the severe liability associated with the cost of clean-up in the event of a fire causing the failure of a polychlorinated biphenyl (PCB) transformer, owners often voluntarily remove the PCBs from their equipment. Several cleaning processes for decontamination were discussed. Diffusion coefficients were measured and used to calculate the rate of PCB leaching from impregnated, solid insulation into the oil used to replace the original PCB dielectric fluid in (to retrofill) askarel transformers. It was shown that it is theoretically unlikely that a simple vapor cleaning system can be used alone to reclassify a transformer as 'non-PCB'. The effect of repeated retrofill operations using a vapor cleaning system were discussed and an alternative procedure which can mitigate the leaching problem described. (See also W88-03223) (Wood-PTT)
W88-03264

PHOTOCATALYZED OXIDATION OF ORGANIC WASTESTREAMS,
Tennessee Technological Univ., Cookeville. Dept. of Civil Engineering.
M. B. Borup, and E. J. Middlebrooks.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 554-568, 7 fig, 6 tab, 18 ref.

Descriptors: *Wastewater treatment, *Photocatalyzed oxidation, *Oxidation process, *Organic compounds, *Ultraviolet radiation, *Hydrogen peroxide, Industrial wastewater, Textile mill wastes, Dimethyl phthalate, Isophorone, Radiation, Chemical oxygen demand, Color removal, Organic carbon.

A process in which hydroxyl free radicals are generated by ultraviolet radiation induced decomposition of hydrogen peroxide, that was injected into the wastestream, has shown potential for treating water that was contaminated with refractory organic compounds. Tests were conducted to determine the feasibility of treating textile dye and finishing wastewater, and water contaminated by the organic pollutants dimethyl phthalate (DMP) and isophorone with the UV catalyzed process. The easily-controlled physical-chemical process successfully removed COD, color, and TOC from the textile dyeing wastewaters. The process also removed DMP and isophorone from the contaminated water. The DMP concentrations were reduced from 50 milligrams/liter (mg/L) to less than 0.05 mg/L in 60 minutes of treatment when dosed with about 125 mg/L of hydrogen peroxide and irradiated with UV radiation with an average intensity of 1200 microwatts/sq cm. An isophorone

concentration of 50 mg/L was reduced to less that 0.05 mg/L in 60 minutes when dosed with 250 mg/L of hydrogen peroxide under the same conditions. Reaction rates were also studied for each of the contaminants. (See also W88-03223) (Wood-PTT)
W88-03266

CARBON ADSORPTION ISOTHERMS FOR ORGANIC CONSTITUENTS OF INDUSTRIAL WASTEWATERS,
Occidental Chemical Corp., Grand Island, NY.
W.-C. Ying, E. A. Dietz, and S. A. Sojka.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 569-582, 10 fig, 5 tab, 17 ref.

Descriptors: *Wastewater treatment, *Adsorption, *Activated carbon, *Isotherms, *Industrial wastewaters, *Organic compounds, Industrial wastes, Chemical analysis, Organic carbon, Phenols, Pollutants, Organic acids, Benzenes, Wastewater, Adsorbents, Adsorptive capacity, Comparison studies.

Organic contaminants in wastewater are often removed using activated carbon adsorbers. Adsorption isotherm data are frequently used to estimate the adsorptive capacity, and thus, the carbon exhaustion rate and the expected service period between carbon bed changes or the size of the carbon regeneration system if is to be accomplished on-site. Because the carbon adsorption isotherm for a compound depends on the testing conditions, the standard isotherm data reported for a single compound in pure water are not useful when a mixture of organic contaminants are to be removed since the effects of competitive adsorption and biological activities are not taken into account. Therefore, the adsorptive capacities of activated carbon for organic constituents of several types of industrial wastewaters were measured in pure water and in wastewater samples for comparison studies. The capacities of carbon for the organic compounds in several types of wastewater samples were significantly reduced from the respective single compound isotherms because of competitive adsorption. Significant capacity reductions were correlated with the fractions of wastewater TOC due to the target compound. It was concluded that actual absorptive capacities of carbon, for all the organic compounds measured in a composite wastewater sample, should be the basis for adsorber design in order to avoid premature breakthrough of many organic contaminants which would result from the overestimation of treatment capability of the carbon adsorber. (See also W88-03223) (Wood-PTT)
W88-03267

MECHANISMS FOR PHOSPHORUS REMOVAL BY A COAL/ALUMINUM MEDIA FILTER,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
A. G. Collins, L. R. Barker, and M. R. Farvardin.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 583-597, 8 fig, 1 tab, 13 ref.

Descriptors: *Wastewater treatment, *Filtration, *Phosphorus removal, *Filters, *Coal-aluminum media filters, Design criteria, Aluminum hydroxide, Detention time, Corrosion, Carbon filters, Adsorption.

The coal/aluminum media filter acts as a combined coagulation-filtration unit for the removal of phosphorus. The mechanisms responsible for this phosphorus removal are discussed since their accurate identification can lead to the efficient design and operation of this treatment system which can potentially lower phosphorus removal capital and operating costs while minimizing sludge production. The results of previous experimentation on phosphorus removal were reviewed. It was found that substantial phosphorus removal was achieved by a coal/aluminum media filter; influent phosphorus concentrations of the order of 5 milligrams phosphorus/liter (mg P/L) were reduced to less than 1 mg P/L for extended periods of 6 to 8 hours. The principal mechanism appeared to be the formation of an aluminum hydroxide surface to which the phosphorus adsorbs. Filter bed detention time affected removal efficiency; the longer the detention time, the greater the removal efficiency. The removal mechanism also depended on the corrosion of aluminum. Effluent aluminum concentrations decreased with time implying a coating of the aluminum media and suppression of corrosion. Suggestions for filter design based on these mechanistic observations are presented. (See also W88-03223) (Wood-PTT)
W88-03268

PHOSPHORUS REMOVAL FROM MUNICIPAL AND INDUSTRIAL WASTEWATER BY ALUMINUM CHLORIDE AND DERIVATIVES,
Villanova Univ., PA. Dept. of Chemical Engineering.
M. J. O'Neill, D. D. Joye, and J. M. Courtney.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 598-606, 4 tab, 8 ref.

Descriptors: *Phosphorus removal, *Wastewater treatment, *Aluminum chloride, *Industrial wastewater, *Municipal wastewater, Coagulants, Poly-aluminum chloride, Polymers, Turbidity, Physical properties, Wastewater, Chemical analysis, Phosphorus, Spectrophotometry.

The phosphorus removal effectiveness of aluminum chloride and its derivatives, including poly-aluminum chloride, was explored. The more traditional coagulants, alum and ferric chloride, were included for comparison, and blends with organic polymer coagulants were also investigated. Turbidity reduction and phosphorus content were obtained in jar tests on real clarifier influents from industrial and municipal sources. Turbidity was obtained by standard turbidimeter measurements; phosphorus content was obtained by well-known spectrophotometric procedures using the ascorbic acid method. Substantial phosphorus removal was achieved by all inorganic agents. The optimum dose for phosphorus removal followed closely, but did not always coincide with, the optimum dose for turbidity removal. Addition of organic polymers resulted in an average of 30% better phosphorus removal. Blends of aluminum chloride and poly-aluminum chloride showed a strong synergistic effect for phosphorus removal from municipal wastewater. Values in the range of .02 -.06 milligrams phosphorus/liter (mg P/L) were achieved in jar tests from wastewaters initially containing 7-13 mg P/L. This is far better than any other coagulant previously reported. However, in heavily loaded industrial wastewater, this synergism was not noted. The presence of biological floc and calcium ions may have affected the performance of the blends negatively. (See also W88-03223) (Author's abstract)
W88-03269

WASTEWATER CHARACTERIZATION AND TREATMENT FOR THE COAL SLURRY PIPELINING INDUSTRY,
Arkansas Univ., Fayetteville. Dept. of Civil Engineering.
J. W. Moore.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 607-617, 3 fig, 7 tab, 4 ref.

Descriptors: *Wastewater treatment, *Coal mining, *Slurries, *Pipelines, *Water quality control, *Industrial wastewater, Slurry pipelining, Conveyance structures, Coal mines, Dewatering, Hardness, Chemical properties, Sulfates, Trace metals, Water quality, Chemical oxygen demand, Biochemical oxygen demand.

The coal slurry pipelining process consists of three steps: (1) slurry preparation, (2) shipment in the pipeline, and (3) slurry dewatering at the receiving site. Because of the large volumes of coal involved, the wastewater characteristics of the water remaining following the dewatering step, and the methods and costs of wastewater treatment, are very important in overall project development. Slurry wastewater characterization studies were conducted in the laboratory using coal obtained from different sources. It was found that the use of slurry pipelines for transporting coal resulted in water quality changes. The parameters of particular interest were hardness, sulfate, trace metals, and biochemical and chemical oxygen demand. Sodium and chloride may be significant for some coals. Several factors were important in determining the magnitude of the water quality changes including: the coal source, the quality of water used to form the slurry, size of the coal, detention time, and mixing characteristics. It was concluded that the significance of the changes in water quality must be assessed on a site-specific basis in order to develop reliable and applicable treatment methods. (See also W88-03223) (Wood-PTT)
W88-03270

COLOR REMOVAL BY CHEMICAL COAGULATION AND ULTRAFILTRATION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
W. R. Knocke, D. Bhinge, and J. J. Joyce.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 618-634, 8 fig, 5 tab, 12 refs.

Descriptors: *Wastewater treatment, *Color removal, *Chemical coagulation, *Ultrafiltration, *Industrial wastewater, *Bleaching wastes, Coagulation, Filtration, Chemical treatment, Pulp and paper industry, Organic carbon, Effluents, Virginia, Hydrogen ion concentration, Organic compounds.

A variety of wastewater treatment options are available for use in treating pulp and paper wastewaters for the removal of color and total organic carbon (TOC) concentrations. Chemical coagulation, chemical oxidation, ultrafiltration, and activated carbon were used previously with varying degrees of success. The integration of these processes was investigated for a treatment system for use in recycling effluent waters as the Union Camp Corporation mill in Franklin, Virginia. It was found that efficient removal of color, especially that which is caused by high molecular weight organic compounds, from pulp and paper wastewaters may be accomplished when using either aluminum or iron salts under optimum pH conditions. TOC removal efficiency by chemical coagulation is a direct function of the organics present and, therefore, a function of the waste source. It was observed that the wastewater produced in the pulping stage of treatment was characterized by low molecular weight organic compounds which were not removed effectively by coagulation. High levels of efficiency were attained in the separation of color and TOC from pulp and paper wastewater with ultrafiltration techniques. (See also W88-03223) (Wood-PTT)
W88-03271

PHYSICO-CHEMICAL TREATMENTS FOR THE COMPLETE REMOVAL OF NON-IONIC SURFACTANTS FROM EFFLUENTS,
Technion - Israel Inst. of Tech., Haifa. Sherman Center for Research in Environmental and Water Resources Engineering.
H. Weinberg, and N. Narkis.
Environmental Pollution EPEBD7, Vol. 45, No. 4, p 245-260, 1987. 7 fig, 4 tab, 16 ref.

Descriptors: *Wastewater treatment, *Surfactants, *Physical treatment, *Chemical treatment, Adsorption, Isotherms, Effluents, Activated carbon.

Adsorption isotherms for a selection of non-ionic surfactants on activated carbons indicated the effectiveness of the latter in the removal of these pollutants from secondary effluents. The removal efficiencies were found to be improved when the

secondary effluent was first flocculated with ferric chloride. This effectively removed some 80% of the non-ionic surfactant in the effluent. Batch adsorption experiments with powdered activated carbon removed 97% of the surfactant at low carbon dosage. A granular carbon with the best adsorption capacity was selected for continuous-flow operation in which non-ionic surfactants, COD and anionic surfactant alkyl benzene sulfonate were monitored. The breakthrough capacity for the non-ionic surfactants was in excess of 6000 bed volumes throughput of flocculated, sand-filtered effluent in a laboratory scale carbon column. Such a procedure is suggested for the complete removal of such pollutants from effluents. (Author's abstract)
W88-03479

5E. Ultimate Disposal Of Wastes

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUBSTANCES.
For primary bibliographic entry see Field 5C.
W88-02513

SEDIMENTATION AND EFFLUENT CONCENTRATION OF SOFT CLAY ON RECLAMATION WORKS,
Japan Bottom Sediment Management Association, Tokyo.
For primary bibliographic entry see Field 2J.
W88-02516

CONTAMINANT MOBILITY AND ENGINEERING DESIGN AT A NEARSHORE CONFINED DISPOSAL SITE -- PORT OF SEATTLE TERMINAL 91 SHORT FILL,
Port of Seattle, WA.
D. A. Hotchkiss, and W. W. Watson.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 65-84, 6 fig, 3 tab, 13 ref.

Descriptors: *Path of pollutants, *Engineering, *Waste disposal, *Seattle, *Slip fill, Dredging, Contaminated sediments, Monitoring, Design standards.

Though the use of a slip fill as a containment site for mildly contaminated dredged material disposal is not unprecedented, the agreements between the Port of Seattle and the regulatory agencies concerning the long-range monitoring and the remedial actions plan are unique. The Port of Seattle's Terminal 91 Short Fill must serve a dual purpose. The fill provides the additional Terminal 91 area required by the major tenant. The fill alao serves as a disposal site for mildly contaminated dredged material unsuitable for open-water disposal from other Port terminal expansion projects. Both goals are complicated by the existing elevated street structure across the head end of the slip, which has necessitated a berm at both ends of this slip fill. As a result a pond is created between the new fill and the old end of the slip. The Port's preferred construction option is disposal of mechanically dredged sediments behind berms of clean structural grade, well sorted, sandy gravel. This will contain the sediments while allowing dewatering of the dredged material through the relatively permeable berms. The Port was initially faced with regulatory agencies unable to appraise the Port's preferred construction option in light of heightened concern over Puget Sound and the lack of field data on contaminant mobility in nearshore disposal sites. A researchlike approach was worked out where the Port did an extensive computer model analysis necessary to apply the existing information to the particulars of the Terminal 91 site. After this showed the option acceptable, the Port, in coordination with the regulatory agencies, designed the Criteria, Thresholds, Monitoring, and Remedial Actions Plans. In addition to the monitoring, the Plan defines the criteria under which containment will be judged, the trigger thresholds, and the remedial actions to be taken if the site does not perform as designed and modeled. This Plan will, through extensive monitoring, study the effectiveness of the fill at minimizing contaminant mobility. It will verify the preproject modeling and reevaluate long-range predictions. This example provides a reasonable approach to pursuing a project when faced with environmental concerns and a lack of directly applicable data. (See also W88-02513) (Author's abstract)
W88-02518

FOOD CHAIN STUDIES AT TIMES BEACH CONFINED DREDGED MATERIAL DISPOSAL SITE, BUFFALO, NEW YORK,
Army Engineer District, Buffalo, NY.
For primary bibliographic entry see Field 5C.
W88-02526

INDIANA HARBOR EXPERIENCE,
Army Engineer District, Chicago, IL.
J. A. Miller.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 213-219, 1 fig.

Descriptors: *Indiana Harbor, *Dredging, *Disposal sites, *Waste disposal, Polychlorinated biphenyls, Corps of Engineers, Contaminated sediments.

Indiana Harbor and Canal is part of a highly industrialized watershed in northwestern Indiana. The bottom sediments within the navigation channel are highly polluted, with two reaches of the canal having polychlorinated biphenyls (PCBs) contamination in toxic levels (>50 ppm). The Corps has been unable to maintain the channel for over 10 years because of the lack of suitable disposal site. The Chicago District is addressing the disposal of maintenance dredgings from Indiana Harbor and Canal along two lines. For the bulk of polluted dredgings, the District is preparing plans for a confined disposal facility to be constructed in Lake Michigan at East Chicago, Indiana. For those sediments contaminated with elevated levels of PCBs, the Chicago District has contracted with the Waterways Experiment Station (WES) to conduct studies on the disposal alternatives for these materials. In addition, WES is assisting the District in evaluating innovative dredging and disposal technologies and conducting a study on the impacts of no-action alternative. (See also W88-02513) (Author's abstract)
W88-02527

LONDON DUMPING CONVENTION AND ITS ROLE IN REGULATING DREDGED MATERIAL: AN UPDATE,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 6E.
W88-02529

TECHNIQUES FOR MONITORING STABILITY OF OFFSHORE SUBMERGED DISPOSAL MOUNDS,
Coastal Engineering Research Center, Vicksburg, MS.
For primary bibliographic entry see Field 7A.
W88-02531

LAND APPLICATION OF MUNICIPAL WASTE WATER,
National Center for Ground Water Research, Norman, OK.
M. B. Tomson, C. Curran, S. R. Hutchins, M. D. Lee, and G. Waggett.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 188-215, 6 fig, 5 tab, 36 ref.

Descriptors: *Groundwater quality, *Wastewater disposal, *Path of pollutants, *Land disposal, Water pollution sources, Dichlorobenzene, Phthalate esters, Trace organics, Drinking water, Groundwater pollution, Model studies.

The potential for land application of municipal wastewater to contaminate groundwater with chromatographable trace level organics (C-TLOs) such as dichlorobenzenes or phthalate esters assessed. Results are given from three rapid infiltration sites, one irrigation site, and one laboratory column study. Two simplified measures of C-TLO removal have been proposed. Average removal efficiencies for land application were generally 90% or better, with concentrations of C-TLOs in the sewage generally <1 micrograms/L and in the groundwater generally <0.1 micrograms/L. A retardation model based upon the organic carbon content of the soil and the water solubility of a compound was proposed to explain these apparent removal efficiencies. Unfortunately, the effectiveness of land application to remove C-TLOs has been deduced based upon failure to measure them in groundwater samples. Several mechanisms (e.g., biodegradation, physical-chemical reaction, volatilization, adsorption, or dispersion) are consistent with such limited observations. With some of these mechanisms, a compound is destroyed, but with others it is still present as a potential groundwater contaminant. For these reasons it would be useful to perform sampling and analyses sufficient in time and space to produce a mass balance for a few compounds. (See also W88-02533) (Lantz-PTT)
W88-02542

BENEFICIAL USES OF DREDGED MATERIAL.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
Available from the National Technical Information Service, Springfield, Virginia, 22161. Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-87-1, March 1987. Final Report. 271 p. Edited by Mary C. Landin and Hanley K. Smith.

Descriptors: *Dredging, *Environmental effects, *Ecological effects, *Spoil disposal, *Recycling, *Waste disposal, *Sediment disposal, *Beneficial use, *Wildlife habitats, Management planning, Symposium, Fisheries, Regulations, Cost-benefit analysis.

The First Interagency Workshop on the Beneficial Uses of Dredged Material was held to improve awareness and acceptability of beneficial use options for dredged material disposal. The workshop discussed past, current, and future beneficial use applications and identified innovative and untested beneficial uses. The workshop aimed to contribute to the development of a logical beneficial use strategy reflected in long-term planning and management. Workshop participants stressed the cultivation of an atmosphere of cooperation, communication, and coordination among Federal and State agencies, the dredging industry, port and maritime authorities, and public and private concerns. Agency and industry overviews were presented and panels were held on the first day, highlighted by a keynote address by the Director of Civil Works of the U. S. Army Corps of Engineers (CE). Three technical sessions on habitat development applications, industrial and commercial applications, and special applications and concpts were held the second day, followed by informal discussion groups for each session. Session summaries and wrapup panels completed the workshop on the thrid day, which was followed by two highly informative tours of Gaillard Island Confined Disposal Facility and Mobile Harbor, Alabama, and the Perdido Key Beach Nourishment Project, Florida. The following conclusions were drawn by workshop participants: beneficial uses already made have been significant; the CE could do more with the beneficial uses concept if it had greater authority to do so; in some areas such as marine fisheries, there are still needs for baseline data on beneficial use sites; every effort to continue seeking beneficial uses should be made; every effort to continue close communication, cooperation, and coordination with other agencies, offices, and concerns must be made; and another interagency workshop should be held in 12 to 18 months. (See W88-02564 thru W88-02583) (Geiger-PTT)
W88-02563

REGULATION OF THE DISPOSAL OF DREDGED MATERIAL IN FLORIDA,
Florida State Dept. of Environmental Regulation, Tallahassee.
V. J. Tschinkel.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 55-60.

Descriptors: *Dredging, *Florida, *Regulations, *Wildlife habitats, *Spoil disposal, *Waste disposal, *Sediment disposal, *Water law, *Environmental effects, Beneficial use, Ecological effects, Permits, Environmental impact statement.

As population increases in Florida, more emphasis is being placed on environmental quality. Recently, a major effort was completed with two other states on the Apalachicola River in relationship to dredged material disposal programs. Many permit projects require upland self-contained disposal sites. Beach disposal would be the first choice of dredged material. Large open-water disposal areas such as Tampa Harbor are also used for disposal. Diposal involving the further destruction of wetlands, riverine floodplains, grass beds, or shellfish harvesting is being discouraged. Disposal plans along the Apalachiocla River involve developing disposal sites that would be the most acceptable from an environmental standpoint. The present involvement of the U.S. Army Corps of Engineers in regulating the environmental impacts of dredging is discussed. (See also W88-02563) (Geiger-PTT)
W88-02564

REGIONAL PERSPECTIVES ON THE BENEFICIAL USES OF DREDGED MATERIAL,
Environmental Protection Agency, Atlanta, GA. Region IV.
J. E. Ravan.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 90-96.

Descriptors: *Spoil disposal, *Waste disposal, *Sediment disposal, *Dredging, *Environmental effects, *Florida, *Ecological effects, *Beneficial use, Environmental impact statement, Project planning, Wetlands, Wildlife habitats, Management planning.

Florida contains over 2000 miles of shoreline to be protected from human intervention through resource development. Dredged materials should be managed with methods that are consistent with the protection of wildlife habitats and wetlands. Dredged materials could be used for filling in sinkholes in various places of the oceans, the rivers, and the bottomlands where water quality is a problems. Dredged materials may be well suited for beach nourishment where erosion problems exist. Dredged materials may also be used for marsh development and habitat development. It is recommended that the U. S. Army Corps of Engineers be given authority to manage dredged materials through a wetlands protection act. (See also W88-02563) (Geiger-PTT)
W88-02565

WILDLIFE AND DREDGED MATERIAL IN THE SOUTHEAST,
Fish and Wildlife Service, Atlanta, GA. Region 4.
J. D. Brown, and W. T. Olds.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 97-105, 6 ref.

Descriptors: *Dredging, *Environmental effects, *Wildlife habitats, *Spoil disposal, *Waste disposal, *Sediment disposal, *Ecological effects, *Beneficial use, Management planning, Project planning, Environmental impact statement, Marsh management, Waterfowl, Wetlands, Salt marshes.

The disposal of vast quantities of dredged materials in the southeastern part of the United States is a major environmental challenge, and has been the cause of numerous controversies and conflicts. Efforts have been made to use dredged material to benefit fish and wildlife. In 1981, the U. S. Army Corps of Engineers (CE) maintenance of the Gulf Intracoastal Waterway in southwestern Louisiana provided a timely opportunity to use dredged material to rehabilitate a portion of the Lacassine National Wildlife Refuge's waterfowl impoundment levee. The frequent CE maintenance of the Calcasieu Ship Channel in southwestern Louisiana has provided an excellent opportunity to create salt marsh on Sabine National Wildlife Refuge using dredged material. Frequent maintanance of the Atchafalaya Bay channel in Louisiana creates dredged materials that are placed on intertidal flats bordering distributary pass channels in the delta to stimulate increased wetland formation. The CE created marsh habitat on the west side of Gaillard Island in Mobile Bay, Alabama after its initial construction in 1980-1981. In the early 1970's, the placement of dredged material from the Buttermilk Sound Salt Marsh, Altamaha River, Georgia caused the establishment of a different kind of habitat than the one which was destroyed by the dredging. Good project planning and coordination are essential in dredging projects to ensure habitat restoration. (See also W88-02563) (Geiger-PTT)
W88-02566

CREATION OF FISHERY HABITAT IN ESTUARIES,
National Marine Fisheries Service, Galveston, TX. Galveston Lab.
For primary bibliographic entry see Field 2L.
W88-02567

OVERVIEW OF THE BENEFICIAL USES OF DREDGED MATERIAL,
Army Engineer Inst. for Water Resources, Fort Belvoir, VA.
For primary bibliographic entry see Field 2L.
W88-02568

HABITAT DEVELOPMENT APPLICATIONS: LOWER POOL 5 CHANNEL MAINTENANCE/ WEAVER BOTTOMS REHABILITATION PLAN,
Fish and Wildlife Service, Winona, MN.
R. F. Berry, and D. D. Anderson.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 134-139, 1 fig, 4 ref.

Descriptors: *Dredging, *Wildlife habitat, *Fisheries, *Channel improvement, *Spoil disposal, *Waste disposal, *Sediment disposal, *Erosion control, *Beneficial use, Sediment erosion, Monitoring, Sedimentation, Project planning, Wind erosion, Waterfowl, Maintenance, Environmental effects, Marsh management, Ecological effects.

A plan to save the marsh vegetation and wildlife of the Weaver Bottoms marsh on the Upper Mississippi River was undertaken by the Fish and Wildlife Service and the U. S. Army Corps of Engineers. The plan includes the construction of six barrier islands and the modification of 14 side channels entering the Weaver Bottoms and Lost Island Lake area. The major factor considered for the design of the islands was to reduce wind fetch to prevent wind-generated wave erosion. Other factors considered in the island design were constructability, stability, aesthetics, and waterfowl nesting. Backwater dredging of fine sediments within Weaver Bottoms, to provide a suitable soil for vegetation of the islands, is part of the selected plan. Side channel modifications to reduce flows would include two rock closures, five dredged material closures, three rock stabilization closures, and four partial closures. The 1.6 MCY of fill material needed to construct the project features would be borrowed from two historic dredged material containment areas. The rehabilitation project is expected to reduce the introduction of sediment into the backwater and reduce erosion and turbidity which in turn whould benefit the aquatic plant community. A 10-yr monitoring program will assess the effectiveness of the project in reaching its stated goals and objectives and identify unforeseen impacts on the environment, public use, and/or navigation. (See also W88-02563) (Geiger-PTT)
W88-02569

HABITAT DEVELOPMENT APPLICATIONS: THE USE OF DREDGED MATERIAL ISLANDS BY BIRDS IN NORTH CAROLINA,
North Carolina Univ. at Wilmington. Dept. of Biology.
J. F. Parnell.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 140-144, 10 ref.

Descriptors: *Dredging, *Wildlife habitat, *Waterfowl, *North Carolina, *Spoil disposal, *Waste disposal, *Sediment disposal, *Marsh management, *Beneficial use, Salt marshes, Population dynamics, Coastal zone management, Wildlife management, Marsh plants.

Censuses were conducted in North Carolina in 1977 and again in 1983 to determine population levels, trends, distribution, and habitat usage of colonial waterbirds nesting in the coastal zone. At dredged material sites, pioneer avifauna was scarcer. This has led to fewer but larger colonies of waterfowl that require bare or nearly bare substrate for nesting. Diking enhances the development of dense vegetation by retaining freshwater and fine particles behind dikes and generally makes islands less suitable for those bird species requiring open conditions for nesting. Nearly 50% of the total number of species recorded for the North Carolina coastal zone have been found on dredged material sites. Dike islands that retained water in temporary ponds, either in unfilled borrow pits or in depressions within dike systems, were also used during fall and spring by migrating shorebirds and in winter as well by waterfowl. These studies show that dredged material sites in coastal North Carolina are valuable habitat for many species of birds and are critical for continued reproductive success of colonially nesting waterbirds. The North Carolina Wildlife Resources Commission, in cooperation with other State, Federal, and private agencies is developing a North Carolina coastal management plan to ensure that the habitat needs of the colonially nesting waterbirds utilizing North Carolina estuaries are met. (See also W88-02563) (Geiger-PTT)
W88-02570

HABITAT DEVELOPMENT APPLICATIONS: USE OF SEAGRASS TRANSPLANTING FOR HABITAT DEVELOPMENT ON DREDGED MATERIAL,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
For primary bibliographic entry see Field 2L.
W88-02571

HABITAT DEVELOPMENT APPLICATIONS: PRESENT AND POTENTIAL USES OF DREDGED MATERIAL WETLANDS AND ISLANDS BY WATERFOWL AND WATERBIRDS IN CHESAPEAKE BAY,
Fish and Wildlife Service, Annapolis, MD.
For primary bibliographic entry see Field 2L.
W88-02573

HABITAT DEVELOPMENT APPLICATIONS: BENEFICIAL USES OF DREDGED MATERIAL ON THE LOWER SNAKE RIVER--PRESENT AND POTENTIAL APPLICATIONS AND CONSTRAINTS,
Corps of Engineers, Walla Walla, WA. Walla Walla District.
J. L. McKern, and N. E. Iadanza.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 168-175.

Descriptors: *Dredging, *Fisheries, *Wildlife habitat, *Beneficial use, *Spoil disposal, *Waste disposal, *Sediment disposal, Improvement, *Aquatic habitat, Channel improvement, Rivers, Dam effects, Environmetnal effects, Ecological effects, Salmon.

Construction of locks and dams on the Columbia and Snake Rivers has generated a need for dredging to establish navigation channels, maintain the minimum channel width and depth as materials shift due to dam/reservoir operation, and remove sediments that deposit in navigation channels or impede flood control operations. In 1976, the Lower Snake River Fish and Wildlife Compensation Plan went into effect to replace anadromous fish losses, resident fish losses, lost wildlife habitat, and lost fishing and hunting opportunities. Several projects that have been initiated to replace lost wildlife habitat and resotre some of the fishery habitat lost to project contstruction are discussed. These projects attempt to use dredged material for beneficial purposes. A proposed project to create habitat for anadrounous fish will involve the dredging and dispoal of up to 800,000 cubic yards of material each year. The planning of this project must be approached by the involved agencies and tribes with caution. (See also W88-02563) (Geiger-PTT)
W88-02574

INDUSTRIAL AND COMMERICAL APPLICATIONS: AN OVERVIEW OF INDUSTRIAL AND COMMERICAL USES OF DREDGED MATERIAL,
American Dredging Co., Camden, NJ.
A. D. Pistilli.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 176-178.

Descriptors: *Dredging, *Beneficial use, *Economic aspects, *Wildlife habitat, *Spoil disposal, *Waste disposal, *Sediment disposal, Environmental effects, Ecological effects, Maintenance, Landfills.

Significant scientific advances have been made to understand and explore the beneficial uses of dredged material. Several airports and highways have been built on meadows and marshes filled by disposed dredged material. Practically all of the inlets in New Jersey have been used as a source of borrow material for beach nourishment. Dredged material has also been used for mussel beds. All the major refineries on the Delaware River are constructed on former dredged material disposal area sites. Half the sanitary landfills today are being capped by maintenance dredging from the upper Delaware River. By making the use of dredged materials commercially and economically attractive, the practice of dredging is likely to continue in the future. (See also W88-02563) (Geiger-PTT)
W88-02575

INDUSTRIAL AND COMMERCIAL APPLICATIONS: THE POTENTIAL FOR INNOVATION IN THE COMMERCIAL USES OF DREDGED MATERIAL,
Maryland Port Administration, Baltimore.
F. L. Hamons.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 186-191.

Descriptors: *Dredging, *Environmental effects, *Estuaries, *Maryland, *Spoil disposal, *Waste disposal, *Sediment disposal, *Beneficial use, Project planning, Monitoring, Public opinion, Ecological effects, Channel improvement, Port facilities.

The recently completed Hart-Miller Disposal Island in Maryland is an island built of dredged material from the Baltimore Harbor channel project. Monitoring for environmental effects is still being carried out on the island. Monitoring adds $2 to $5 a cubic yard to the cost of dredging in Baltimore. The 50-ft channel project will fill Hart-Miller island in 5 to 7 yr, instead of the projected 10 to 20 yr. A pilot study should be conducted to test proposed disposal methods for the dredged material which will result from the laying of the Interstate-95 tunnel. A long-term approach to projet planning utilizes an advisory system where State, Federal, other agencies, and the public are consulted for reaction to proposed projects. (See also W88-02563) (Geiger-PTT)
W88-02577

INDUSTRIAL AND COMMERCIAL APPLICATIONS: POTENTIAL BENEFICIAL USE APPLICATIONS TO THE MARINE SAND AND GRAVEL MINING INDUSTRY,
Minerals Management Service, Long Beach, CA.
R. G. Paul, and R. Stone.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 192-197.

Descriptors: *Dredging, *Minerals, *Marine sediments, *Environmental effects, *Waste disposal, *Sediment disposal, *Beneficial use, Economic aspects, Ecological effects, Gravel, Sand, Cobalt, Sulfides, Phosphorus compounds, Nickel, Manganese, Platinum, Titanium.

The minerals leasing program conducted by the Office of Strategic and International Minerals for the U. S. exclusive economic zone (US EEZ) is discussed. The US EEZ covers approximately 3 billion acres, the territory contiguous to the 50 States, commonwealth of Puerto Rico and Northern Marianas, and the U. S. territories and possessions in the Pacific. The area is explored by a heavy box dredge or chain bag drege which is towed behind the vessel. Camera work is done using a pogo system. The Gorda Ridge Federal-State Task Force is investigating the occurrence of massive sulfides. Cobalt, nickel, manganese and platinum are present in the Gross Seamount. Another task force is looking for phosphorites off the coast of North Carolina, while titanium is being sought off the coast of Georgia. Sand and gravel will have high priorities for future initiatives in the northeast Atlantic and offshore southern California. Mining for sand and gravel offshore in the United Kingdom occurs primarily in the English Channel and the North Sea off the southeastern Bristol Channel and off Liverpool. Commerical fishing conflicts are a major consideration, and procedures have been set for minimizing fisheries impacts through a Code of Practice for the Extraction of Marine Aggregate. (See also W88-02563) (Geiger-PTT)
W88-02578

SPECIAL APPLICATIONS AND CONCEPTS: USE OF DREDGED MATERIAL CONTAINMENT AREAS FOR AQUACULTURE,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. D. Lunz, and M. Konikoff.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 202-208, 2 ref.

Descriptors: *Dredging, *Aquaculture, *Beneficial use, *Environmental effects, *Spoil disposal, *Waste disposal, *Sediment disposal, *Shrimp, Ecological effects, Aquatic habitat, Marsh management, Wetlands, Levees, Shellfish, Fisheries.

Dredged material containment areas (DMCAs) offer several economically attractive features for use as aquaculture sites. DMCAs are commonly diked and employ water control devices. Costs associated with land acquisition, levees, and water control device construction could be wholly or partially absorbed by the Federal Government or by the local sponsor of the dredging project. Both freshwater and coastal DMCAs are often located near favorable water sources, on waterfront property that might otherwise not be available to the aquaculturist, and near large market areas with established transportation routes. The U. S. Army Corps of Engineers is conducting a 3-yr aquaculture project in a DMCA located adjacent to the Brownsville Ship Channel, near Brownsville, Texas. The exotic white shrimp, Pennaeus vannamei, is being grown in two DMCAs of approximately 125 acres each. The project will test and refine procedures for containment area aquaculture on a commercial scale. Water for the aquaculture pond will be pumped from the ship channel. Water level within a pond will be controlled during the initial phases of operation by a weir-type spillway structure placed into the primary levee and designed for both water-level control and drain harvest. Water quality of the pond will be monitored throughout the project. Future prospects for the culture of redfish, exotic and native shrimps, hybrid striped bass, bait shrimp and bait fishes in DMCAs seem promising. (See also W88-02563) (Geiger-PTT)
W88-02579

SPECIAL APPLICATIONS AND CONCEPTS: INNOCENT UNTIL PROVEN GUILTY,
W. E. Pequegnat.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 209-214.

Descriptors: *Dredging, *Environmental effects, *Estuaries, *Beneficial use, *Spoil disposal, *Waste disposal, *Sediment disposal, Ecological effects, Marine sediments, Sediment transport, Fisheries, Berms.

Research on the beneficial uses of dredged materials should also incorporate studies to reduce the amount of material that must be disposed of. As volumes of dredged materials increase, the problems of disposal are likely to intensify. Misconceptions about the safety of dredged material have made disposal of it difficult in some areas. Because most contaminants in dredged materials are tightly bound to clays and other constituents, the relative availability of the toxicants to organisms is far less than in the case of other wastes. The amount of sediment to be dredged may be reduced by controlling inputs from the source or by redesigning waterways. Some dredging/disposal practices should be modified with the intention of reducing the number of times the same sediment has to be dredged. Dredged material may be used benefically for the creation of fishing reefs, clam beds, or underwater berms. Dredged material is productively used in the coarse and fine ceramic industries as raw material for making building blocks, bricks, roofing, tiles and earthenware. Dredging often occurs at locations very distant from potential areas of use. The U. S. Army Corps of Engineers could assist in meeting the cost of additional haul distances by using funds that would be saved by reducing unnecessary dredging. Some promising uses for the alleviation of dredged material disposal problems are the creation of subaqueous berms to reduce wave erosion and the creation of subaerial berms to elevate beaches. (See also W88-02563) (Geiger-PTT)
W88-02580

SPECIAL APPLICATIONS AND CONCEPTS: SHORELINE NOURISHMENT--THE GULF ISLANDS NATIONAL SEASHORE EXPERIENCE,
National Park Service, Gulf Breeze, FL. Gulf Islands National Seashore.
R. W. Thackeray.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 215-220.

Descriptors: *Dredging, *Beneficial use, *Erosion control, *Beach erosion, *Spoil disposal, *Waste disposal, *Sediment disposal, *National parks, Wildlife habitats, Environmental effects, Ecological effects, Coastal zone management, Recreation, Seashores.

When the U. S. Navy's homeporting plan for Gulf Coast ports was announced in 1985, large amounts of dredged beach quality material became available that could be disposed of on eroding beaches in the

Seashore adjacent to the Pensacola Pass, Gulfport and Pascagoula ship channels. Three dredged material-related projects that have been accomplished through interagency cooperation and have proven beneficial to the natural, cultural, and recreational resources of the Seashore are described. Beach erosion along Fort Massachusetts has been controlled by disposing of dredged material from the Gulfport ship channel adjacent to Ship Island to the west of the channel. Another beneficial project currently maintained by the U. S. Army Corps of Engineers (CE) is the dredged material island located between Petit Bois Island and Horn Island that was created with material from the maintenance dredging of the Pascagoula ship channel and impoundment basin. The dredged material island serves as a rare and unique habitat for nesting marine and shore birds. In the case of the Perdido Key beach nourishment project, the NPS, CE, and Navy all cooperated to protect a threatened natural resource while achieving their own particular objectives. The Navy, in anticipation of the need to widen and deepen the ship channel to accommodate a large-deck aircraft carrier, provided the funding for the project. The CE changed the method of dredging from hopper dredge to hydraulic pipeline that could transport material from the channel directly to the surfzone seaward of the beach berm. The NPS in turn endorsed a disposal permit for which there was no precedent. Because of favorable monitoring results, another nourishment project is planned for 1987 utilizing material from the military channel project. (See also W88-02563) (Geiger-PTT)
W88-02581

SPECIAL APPLICATIONS AND CONCEPTS: THE UPPER MISSISSIPPI RIVER ON-SITE INSPECTION TEAM--A PROCESS THAT WORKS,
Fish and Wildlife Service, Rock Island, IL.
J. G. Millar.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 221-225.

Descriptors: *Spoil disposal, *Waste disposal, *Sediment disposal, *Dredging, *Mississippi River, *Monitoring, *Environmental impact statement, *Management planning, Project planning, Evaluation, Channel improvement, Maintenance, Flood plain management, Environmental effects, Ecological effects, Beneficial use.

In 1974, the Division Engineer of the U. S. Army Corps of Engineers (CE) and Regional Director of FWS announced that they would form a partnership team to manage the navigational channel for the Upper Mississippi River. This team, known as the Great River Environmental Action Team (GREAT) divided its studies along three reaches of the river: GREAT I from Minneapolis to Guttenberg, Iowa; GREAT II from Guttenberg to Saverton, Missouri; and GREAT III from Saverton to Cairo, Illinois. Interagency coordination procedures were developed for channel maintenance and dredging. For GREAT II, this included the development of the Channel Maintenance Handbook and the On-Site Inspection Team. The Channel Maintenance Handbook sets forth the On-Site Inspection Team process and provides an invaluable tool to Team functions. It sets the objectives, site selection priorities, and also contains pool maps referencing dredge cuts, and historic and alternative disposal sites. The On-Site Team tries to reach a consensus on a recommended disposal site. In the event a consensus cannot be reached at the meeting, the majority recommendation is forwarded to the CE with a written discussion concerning dissenting opinions. The On-Site Inspection Team also makes recommendations concerning mitigation requirements such as revegetation. Following the dredging season, the On-Site Inspection Team conducts a post-disposal evaluation. (See also W88-02563) (Geiger-PTT)
W88-02582

SPECIAL APPLICATIONS AND CONCEPTS: BENEFITS OF UNDERWATER BERMS,
Corps of Engineers, Mobile, AL. Mobile District.
J. P. Langan.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 226-233, 3 ref.

Descriptors: *Dredging, *Berms, *Erosion control, *Marine fisheries, *Spoil disposal, *Waste disposal, *Sediment disposal, *Environmental effects, Ecological effects, Monitoring, Coastal zone management, Pilot studies, Littoral zone, Environmental impact statement, Beneficial use.

Berm projects help to utilize rather than just dispose of dredged materials. Stable berm construction involves placement of the berm in deeper water so that it is less affected by waves and currents. Feeder berms involve placement in shallower water where the disposed material would be moved in the littoral process. The stable berm could dissipate wave energy thereby reducing the potential for shoreline erosion. There would be a zone of reduced wave energy between the completed berm and the shoreline in which additional materials could be stockpiled for future beach nourishment, such as may be required after a storm or hurricane. Conventional pipeline dredges could recover this material for direct beach placement at a much reduced cost. Feeder placement would replace and supplement sandy material in the littoral process and over a period of time reduce to some extent the erosion to downdrift beaches. Hopper dredges have been used to place sand close to shore for years. Construction of an underwater berm depends very much on precise control over the exact position of release. The split-hull design allows faster releases in shallower water than the older hopper dredges. A pilot study on berm placement was conducted by the Norfolk Army Corps of Engineers (CE) District and CERC off of Virginia Beach in the Dam Neck storage area. The Norfolk study concluded that conventional hopper dredges and the electronic positioning equipment routinely used by the industry are capable of constructing a moderate- to high-relief bottom feature in an economical manner, even when the placement material is a mixture of fine sand and silt. CERC and Norfold District CE also tested a variety of monitoring equipment and techniques to determine the physical behavior of an underwater berm. Results showed that more work is needed in further developing and standardizing physical monitoring equipment and techniques. A full-scale demonstration will be conducted off of Dauphin Island, Alabama, in the nearshore zone at Mobile Harbor. (See also W88-02563) (Geiger-PTT)
W88-02583

GROUNDWATER CONTAMINATION.
National Research Council, Washington, DC.
Available from the National Technical Information Service, Springfield, Virginia. 22161, as PB84-24142. Price codes: A09 in paper copy, A01 in microfiche. National Academy Press, Washington, DC. February 1984. 179 p.

Descriptors: *Groundwater pollution, *Water pollution effects, *Water pollution sources, *Waste disposal, *Aquifers, *Water quality control, Groundwater recharge, Path of pollutants, Groundwater movement, Geohydrology, Water pollution prevention, Water quality management, Radioactive wastes.

The reliable assessment of hazards or risks arising from groundwater contamination problems and the design of efficient and effective techniques to mitigate them require the abilty to predict the behavior of contaminants in flowing groundwater. Increased understanding of the effects of chemical (inorganic and organic) and biological reactions on transport of contaminants and the quantification of flow in fractured rocks are needed for more reliable prediction of contaminant movement. The challenge for the future is to prevent the introduction of contaminants into groundwater and to attempt to rectify past mistakes. The prevention of groundwater contamination is more cost-effective than aquifer restoration. Although there are many sources of groundwater contamination - domestic septic systems, accidental spills, and extensive use of fertilizers, herbicides, and pesticides, for example - the most widely known sources are waste disposal practices. The report argues that the subsurface can be safely used for waste disposal if sites are selected, designed, and engineered in terms of the hydrology, geology, hydrogeochemistry, microbiology, and the nature of the wastes. This will necessitate both a more thorough search for repository sites and the development of a strategy that provides for segregation, treatment, and disposal of wastes according to their chemical affinities. (See W88-02603 thru W88-02616) (Author's abstract)
W88-02602

SHALLOW LAND BURIAL OF MUNICIPAL WASTES,
Illinois State Geological Survey Div., Champaign.
K. Cartwright.
Groundwater Contamination, National Academy Press, Washington, DC. February 1984. p 67-77, 3 fig, 5 tab, 34 ref.

Descriptors: *Municipal wastes, *Waste disposal, *Landfills, *Groundwater pollution, *Leaching, *Path of pollutants, *Water pollution sources, Leachates, Geohydrology, Waste dumps, Sanitary landfills, Hazardous materials.

Environmental laws and regulations promulgated since the early 1960's have increased the use of the sanitary landfill and changed its character. Total isolation of wastes from the environment is not possible; some migration of leachate from wastes buried in the ground will always occur. Disposal sites should be judged on a site-by-site basis rather than by rigid criteria for site selection and design. The performance should take into account several factors: the nature of the wastes; the site hydrogeology, including a complete water balance, the attenuation of contaminants by geologic materials; and the release rate of unattenuated contaminants to surface waters of groundwaters. In recent years there has been a trend away from numerous, small disposal sites toward fewer and larger sites. Large disposal sites increase the environmental stress, since the attenuation capacity of the geologic material has a finite, though generally not well-defined limit. Fine-grained geologic materials, which have low hydraulic conductivities and attenuating characteristics considered favorable for waste disposal, are geologic conditions generally considered suitable for disposal of wastes. Lanfill covers are, perhaps, the least regulated engineered part of sanitary landfills, yet they are critical in controlling leachate migration and the water balance. Also, the role of migration in the unsaturated zone is often overlooked, especially in humid areas. (See also W88-02602) (Author's abstract)
W88-02606

DEEP BURIAL OF TOXIC WASTES,
Arizona Univ., Tucson.
S. N. Davis.
Groundwater Contamination, National Academy Press, Washington, DC. February 1984. p 78-89, 9 fig, 40 ref.

Descriptors: *Waste disposal, *Hazardous materials, *Path of pollutants, *Leaching, *Groundwater pollution, Leachates, Degradation, Waste dumps, Permeability, Groundwater movement.

Deep burial of toxic wastes provides several advantages over disposal in surface structures or by shallow burial. The primary advantage of deep burial is the high degree of physical isolation that it provides. Some of the hydrogeologic advantages of deep burial are: increase in length of flow path of contaminants that may become dissolved in groundwater; increased protection of waste against weathering and erosion; for some wastes and waste containers, elimination of free oxygen that may mobilize certain constituents; and for plutonic rocks and to some extent all rocks, reduction of permeability with depth. Primary disadvantage of deep burial is the high cost of exploration, development, and monitoring of deep disposal systems. Reduction of permeability with depth in metamorphic and plutonic igneous rocks is well defined to

depths of about 300 m. Further reduction of permeability with depth probably takes place but is difficult to quantify using present data. Most of the reduction in permeability with depth in sedimentary rocks is within the upper 100 m. The reduction of permeability is generally at least three orders of magnitude from near the land surface to depths of 100 m for all types of indurated rocks. Based on hydrogeologic criteria alone, many different rock types should provide safe waste repositories at depths greater than 100 m. Deep repositories in most locations will eventually fill with water. However, if zones of significant groundwater circulation are either avoided or grouted, repositories at depths of more than 300 m in granitic rocks should take several hundred years to fill with groundwater once they are closed. In a well-placed repository, several thousand years may be needed to accomplish a simple piston-flow displacement of all water in the flooded repository. Even this length of isolation may not allow enough time for the degradation of all wastes to take place, but a long isolation time will most commonly mean a slow release of mobile contaminants into the biosphere, which, in turn, suggests that dilution will be more effective than in the case of a fast release of contaminants from shallow burial sites. (See also W88-02602) (Author's abstract)
W88-02607

GEOLOGIC PROBLEMS AT LOW-LEVEL RADIOACTIVE WASTE-DISPOSAL SITES,
Geological Survey, Reston, VA.
J. B. Robertson.
Groundwater Contamination, National Academy Press, Washington, DC. February 1984. p 104-108, 1 fig, 7 ref.

Descriptors: *Radioactive waste disposal, *Groundwater pollution, *Leaching, *Path of pollutants, *Landfills, Radioactive wastes, Water pollution sources, Waste dumps, Leachates, Waste management, Site selection, Groundwater level, Erosion.

Less-than-desirable geohydrologic containment has occurred at three commercially operated and three Department of Energy-operated low-level radioactive waste-disposal sites in the United States. Studies of these sites indicate that the problems fall into eight general categories: 'bathtub effect' (water accumulation in filled trenches), trench-cap integrity, erosion, high water table, hydrogeologic complexity, flooding, complex leachage chemistry, and rapid radionuclide migration in groundwater. Problems have been encountered in both high-permeability and low-permeability burial media. All of these problems appear avoidable by applying the following more practical, comprehensive, and commonsense earth-science guidelines for site selection and design: a very arid environment eliminates most problems; the bathtub effect can be avoided by using physically stable waste forms and by improving the design of the cap; acceptable humid-zone sites can be constructed in permeable media if the water table is sufficiently deep and capillary forces (the 'wick effect') are used to divert percolating water from the waste; and an important factors is to select sites in relatively simple geohydrologic environments to facilitate the prediction of their containment properties. (See also W88-02602) (Author's abstract)
W88-02609

HYDROGEOCHEMICAL STUDIES AT A LANDFILL IN DELAWARE,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 5B.
W88-02612

HAZARDOUS WASTE MANAGEMENT HANDBOOK.
For primary bibliographic entry see Field 5D.
W88-02640

HAZARDOUS WASTES IN THE UK - AN OVERVIEW,
Open Univ., Milton Keynes (England).
A. Porteous.
IN: Hazardous Waste Management Handbook, Butterworths, London, England. 1985. p 1-15, 1 fig, 7 tab, 8 ref, 3 append.

Descriptors: *Hazardous wastes, *Waste disposal, *United Kingdom, Legislation, Monitoring, Landfills, Disposal sites, Regulations.

The United Kingdom has a long track record of monitoring the enviornment and taking steps to improve it where warranted. The use of coal was prohibited in London in 1273 as the fumes were considered to be prejudicial to health. A more recent statement of the UK's concern for the environment is given in a listing of official reports from the Department of the Environment in an appendix to this chapter. So far as hazardous wastes are concerned, they first came under official scrutiny in 1964 when a Technical Committe on the Disposal of Solid Toxic Wastes, under the Chairmanship of Dr A. Key, was set up. The 'Key Committee' catalogued several dangerous practices in the course of its investigations, and finally reported in March 1970 with, in retrospect, far-reaching conclusions on how toxic wastes should be managed. Loopholes which permitted fly tipping to occur with little risk of detection but 'with results that can be and have been very serious' were highlighted. Other recommendations focused on the need for effective tip management, the control of percolation through toxic waste landfill sites and the avoidance of water pollution. The next UK foray into hazardous wastes was conducted by the Royal Commission on Environmental Pollution, which took up the challenge of the need for legislation to control the tipping of potentially dangerous wastes on land. Virtually coincidentally with the publication of this report, the Deposit of Poisonous Waste Act, 1972 was passed. This Act remained the principal method of UK hazardous waste management until the Control of Pollution (Special Waste) Regulations, 1980 came into force arising from Section 17 of the Control of Pollution Act, 1974. (See also W88-02640) (Lantz-PTT)
W88-02641

LEGAL CONTROL OF HAZARDOUS WASTE MANAGEMENT AND TRANSPORT IN THE UK,
Cleanaway Ltd., Rayleigh (England).
R. Hawkins.
IN: Hazardous Waste Management Handbook, Butterworths, London, England. 1985. p 16-67, 10 ref, 8 append.

Descriptors: *Legal aspects, *Hazardous wastes, *Waste management, *United Kingdom, Waste disposal, Legislation, Regulations, Risk assessment.

This paper presents waste transport and management from both a legislative and historical point of view. Discussions include: (1) hazard and risk; (2) classificattion of unwanted materials; (3) the development of hazardous waste legislation; (4) the Poisonous Waste Act; (5) overall statutory duties of a Waste Disposal Authority; (6) the Control of Pollution Act, 1974; (7) licensed sea deposit; (8) health and safety at work; and, (9) transport of hazardous waste material. (Lantz-PTT)
W88-02642

HYDROGEOLOGICAL ASSESSMENT AND SELECTION OF HAZARDOUS WASTE DISPOSAL SITES,
FGS Associates Ltd., Sipson (England).
M. J. Carter.
IN: Hazardous Waste Management Handbook, Butterworths, London, England. 1985. p 68-97, 5 fig, 10 ref.

Descriptors: *Geohydrology, *Waste disposal, *Disposal sites, *Site selection, *Hazardous wastes, *Water pollution prevention, Path of pollutants, Landfills, Aquifers, Regulations, Water quality control.

For both environmental and economic reasons it is necessary to undertake a hydrogeological assessment of a potential waste disposal site and, during the course of the assessment, sites suitable for the disposal of hazardous wastes are identified. The hydrogeological assessment, in conjunction with planning matters and other considerations, determines the range of wastes for which the site will be suitable. The hydrogeological assessment also identifies measures which must be taken during the operation of the site to prevent the development of operational and environmental problems. Naturally contained sites have the advantage of preventing significant movement of contaminants away from the site by virtue of the low permeability of the surrounding ground, which also provides conditions conducive to the attenuation of contaminants. These sites have had the disadvantage of requiring precise planning and careful management to prevent the accumulation of leachate which may ultimately fill the site and overflow. Engineered contained sites using artificial liners have the same disadvantages as naturally contained sites without the advantages of the properties of the surrounding ground. In addition, the liners require a high standard of preparation of the site before installation and may be damaged during the operation of the site. Non-contained sites exhibit such a range of properties that they may be suitable in some cases for the disposal of a wide range of hazardous wastes and in other cases for inert materials only. Non-contained sites are commonly located on aquifers which are utilized for water supply and therefore require careful assessment to ensure that groundwater resources are protected. The hydraulic continuity between ground and surface water must also be considered when assessing a potential landfill site on an aquifer. (See also W88-02640) (Lantz-PTT)
W88-02643

LEACHATE PRODUCTION, CONTROL AND TREATMENT,
Cleanaway Ltd., Rayleigh (England).
K. Knox.
IN: Hazardous Waste Management Handbook, Butterworths, London, England. 1985. p 98-145, 7 fig, 16 tab, 66 ref.

Descriptors: *Leachates, *Hazardous wastes, *Wastewater treatment, *Water pollution sources, *Water pollution control, *Waste disposal, Landfills, Path of pollutants, Costs, Monitoring.

Leachate is the contaminated water produced when clean water such as rain or groundwater percolates through the wastes contained in a landfill. It is fair to say that at many landfills, leachate is the biggest single environmental problem facing the operator. In some cases serious harm could result from inadequate control. Severe leachate problems have occurred at completed sites as well as at currently operational sites. At some of these sites industrial wastes have been deposited. Sometimes the problem of leachate control has been made more difficult, and the threat to the environment increased as a result. It is almost certain that leachate, along with gas, smells, flies, birds and litter, will continue to pose problems to some landfill operators. In the case of landfills where industrial or hazardous wastes are accepted, it is particularly important that operators and their advisors are prepared for the possible production of leachate and are familiar with the disciplins to be followed in controlling it. The purpose of this chapter is to set out those disciplines and to summarize the large amount of new knowledge that has accumulated. In the UK at least, it is only just over ten years since widespread scientific study of leachates and of industrial wastes in landfills began, and much has been learned in a relatively short time. In this chapter, several sections are concerned with assessing and controlling the size of the problem by understanding, measuring and controlling leachate production, monitoring its characteristics and controlling its characteristics. In another section, ultimate treatment and disposal options are discussed, with the aid of case histories where available. (See also W88-02617) (Lantz-PTT)
W88-02644

SOLIDIFICATION PROCESSES,
For primary bibliographic entry see Field 5D.
W88-02645

ALTERNATIVES TO LANDFILL,
Re-Chem International Ltd., Southampton (England).
A. K. Coleman.
IN: Hazardous Waste Management Handbook, Butterworths, London, England. 1985. p 209-255, 5 fig, 20 tab, 14 ref.

Descriptors: *Hazardous wastes, *Landfills, *Waste disposal, *Waste treatment, Recycling, Chemical treatment, Biological treatment, Incineration, Sea disposal, Ocean dumping.

History has often demonstrated the potentially disastrous consequences of irresponsible and careless disposal of hazardous wastes. The resultant public outcry and response of government by way of legislation to effect control over such activities, has provided a demand for alternative options to landfill. Such demand has now been met and adequate hazardous waste disposal facilities, providing a wide range of options, now exist to support the pursuit of an environmentally protective and socially responsible waste disposal strategy. The disposal options available can conveniently be divided into five basic concepts. These are: recycling, chemical treatment, biological treatment, incineration, and sea disposal. The choice of disposal routes or options for hazardous waste, more often than not rests with the waste producer, who will be automatically attracted to landfill for good economic reasons. The security of that option invariably rests with the site operator and is dependent upon the standard of waste management exercised. The scope for abuse is considerable and the waste disposal industry has sometimes been skating on thin ice. Justone of two serious accidents could have a disasterous affecton public confidence in landfill, and this must be prevented. Accordingly, landfill must not be used in marginal cases because it is cheap - the 'cheapest tolerable means' approach - and all hazardous waste disposal must be subject to rigorous control. It is essential, therefore, that a sensible balance is maintained in the demand for the various options in order to preserve the commercial confidence of the companies providing the alternative treatment facilities. (See also W88-02640) (Lantz-PTT)
W88-02647

RECYCLING, RECLAMATION AND WASTE REDUCTION THROUGH PROCESS DESIGN,
UKAEA Atomic Energy Research Establishment, Harwell (England).
For primary bibliographic entry see Field 5D.
W88-02648

RADIOACTIVE WASTE DISPOSAL,
Open Univ., Milton Keynes (England).
I. Boustead.
IN: Hazardous Waste Management Handbook, Butterworths, London, England. 1985. p 281-297, 2 tab, 12 ref.

Descriptors: *Radioactive wastes, *Waste disposal, *Hazardous wastes, Toxicity, Disposal sites.

The use of radioactive materials by industry and medicine poses some unique disposal problems. Apart from the chemical toxicity of some isotopes, there is the additional potential hazard of their radioactivity. However, the disposal of such waste is governed by regulations, which, if rigorously applied, would prevent exposure of both workers and the general population to damaging doses of radiation. This chapter is concerned with the principles underlying the treatment and disposal of low-level wastes of the type commonly found in medical establishments. In particular it attempts to summarize the underlying science so that the need for specific regulations and their intelligent application is more readily appreciated. It is not concerned with the treatment, storage and disposal of medium- to high-level wastes of the type found in the nuclear processing industries but, the same general principles still apply. (See also W88-02640) (Lantz-PTT)
W88-02649

FREE-LIVING DINITROGEN-FIXING BACTERIA ISOLATED FROM PETROLEUM REFINERY OILY SLUDGE,
Lyon-1 Univ., Villeurbanne (France). Lab. d'Ecologie Microbienne.
For primary bibliographic entry see Field 5A.
W88-02712

LONG-TERM SLUDGE APPLICATIONS ON CADMIUM AND ZINC ACCUMULATION IN SWISS CHARD AND RADISH,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
A. C. Chang, A. L. Page, and J. E. Warneke.
Journal of Environmental Quality JEVQAA, Vol. 16, No. 3, p 217-221, July-September 1987. 4 fig, 3 tab, 23 ref.

Descriptors: *Sludge disposal, *Waste disposal, *Water pollution effects, *Heavy metals, *Bioaccumulation, *Swiss chard, *Radish, Food crops, Path of pollutants, Sludge, Cadmium, Zinc, Model studies.

Swiss chard (Beta vulgare var. Fordhook) and radish (Raphanus sativus var. Cherry Belle) were grown twice annually (spring and fall) on a Ramona sandy loam (fine-loamy, mixed thermic, Typic Haploxeralfs) soil treated with 0, 22.5, 45, 90, and 180 Mg/ha/yr of composted sludges from Los Angeles. The soil received two sludge inputs of equal amounts each year and crops were planted shortly after each sludge incorporation. Cadmium and Zn accumulation of the plant tissue from 1976 to 1985 was examined. Results from the analysis of variance indicated that effects due to sludge application rates, seasons plants were grown, number of years of sludge application, and their interactions were all significant. If the data sets were partitioned according to sludge application rates and seasons, metal concentrations of the plant tissue may be expressed as a nonlinear regression model, $y = a + b\,(1 - e$ to the minus cx power), where y is the metal concentration of the plant tissue, x is the cumulative sludge loading, and a, b, and c are constants. All but two nonlinear regressions were significant at $p < 0.05$ with R sq from 0.38 to 0.95. The deviation of the observed values from the predictions of the regression model indicated that other factors might have also affected the metal uptake by plants. Stepwise multiple regression analysis of the partitioned data sets indicated that soil pH, soil salinity, soil temperature, and length of growing season influenced the metal accumulation in plant tissue. (Author's abstract)
W88-02717

NITROGEN MINERALIZATION IN SEWAGE-SLUDGE-AMENDED COAL MINE SPOIL AND TOPSOILS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
G. Voos, and B. R. Sabey.
Journal of Environmental Quality JEVQAA, Vol. 16, No. 3, p 231-237, July-September 1987. 7 fig, 2 tab, 28 ref.

Descriptors: *Mineralization, Sludge disposal, *Waste disposal, *Water pollution effects, *Biodegradation, *Mine wastes, *Nitrogen, Incubation, Sludge, Wastewater, Nitrates, Kinetics.

A 16-week laboratory incubation was conducted to determine the rate of net N mineralization in sewage-sludge-amended coal mine spoil, two topsoils, a 1:1 mixture of the spoil with each topsoil, and a quartz sand. Sewage sludge was added at rates of 0, 40, 80, and 120 Mg/ha, which added 0, 1630, 3260, and 4890 kg N/ha, respectively. The total amount of inorganic N that accumulated during the experiments increased significantly as the rate of sewage sludge addition increased in each of the materials and mixtures tested. However, the rate of sludge addition did not have a similar effect on the amount of NO3-N accumulated. The soil materials did affect the amount of NO3-N that accumulated in 16 weeks. Little or no NO3-N had accumulated in any of the sand treatment samples and only small amounts were produced in the spoil. Ammonium-N increased with increasing rates of sewage sludge in all materials and mixtures examined. The rate of ammonification was more stable after the 8-week sampling interval in most cases. Mineralization of organic N added with the sewage sludge varied between 10 to 34%. At all rates of sludge addition, more organic N was mineralized in stock piled topsoil than in the other materials. A nonlinear least squares regression equation for N mineralization as first-order kinetics slightly overestimates N mineralization in the 4- to 8-week interval and slightly underestimated N mineralized through 16 weeks. (Author's abstract)
W88-02719

ELEMENT LEACHING AND CAPILLARY RISE IN SANDY SOIL CORES: EXPERIMENTAL RESULTS,
Atomic Energy of Canada Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.
For primary bibliographic entry see Field 2G.
W88-02722

REQUIREMENTS ON THE HANDLING OF CHEMICALS AND WASTES REGARDING SOIL AND GROUNDWATER PROTECTION,
Umweltbundesamt, Berlin (Germany, F.R.).
For primary bibliographic entry see Field 4C.
W88-02727

EFFECT OF SUGAR MILL EFFLUENT ON OXYGEN UPTAKE AND CARBON DIOXIDE OUTPUT OF RICE (ORYZA SATIVA L.C.V. MUSHOORI) SEEDLINGS,
Maharshi Dayanand Univ., Rohtak (India). Dept. of Biosciences.
For primary bibliographic entry see Field 5C.
W88-02730

WASTEWATER DISPOSAL AND TREATMENT,
Oklahoma Univ., Norman.
For primary bibliographic entry see Field 5D.
W88-02738

MODEL TO PREDICT WATER DEMAND, WASTEWATER DISPOSAL, COST OF TREATMENT SYSTEMS, AND EQUIPMENT REQUIRED,
Oklahoma Univ., Norman.
For primary bibliographic entry see Field 5D.
W88-02739

LAND TREATMENT OF MUNICIPAL WASTEWATER: VEGETATION SELECTION AND MANAGEMENT.
Ann Arbor Science, Ann Arbor, MI. 1982. 218 p. Edited by Frank M. D'Itri.

Descriptors: *Land disposal, *Wastewater disposal, *Wastewater treatment, *Irrigation design, *Wastewater irrigation, Soil-water-plant relationships, Vegetation effects, Soil amendments, Vegetation, Crop production, Water reuse, Municipal wastewater, Plant pathology, Grasses.

Since the enactment of the 1977 Clean Water Act Amendments of P. L. 92-500, land treatment of municipal wastewater has become more popular, requiring better selection and management of vegetation for land treatment facilities. To develop guidelines for vegetation management for the north-central region (the upper Mississippi and Ohio River drainage areas) and the Great Lakes Basin, a conference/workshop was presented at Michigan State University February 23-25, 1981. Papers compiled prior to and at this conference are organized into twelve chapters covering the following topics: the selection and management of vegetation for slow rate systems to treat municipal wastewater in the North Central United States; selection of irrigation system design; wastewater crop management studies in Minnesota, crop management studies at the Muskegon County Michigan Land Treatment System; comparison of the crop management strategies developed from studies at Pennsylvania State University, University of Min-

nesota, Michigan State University, and the Muskegon County Land Treatment System; management studies of annual grasses and perennial legumes and grasses at the Michigan State University Water Quality Management Facility; old field management studies on the Water Quality Management Facility at Michigan State University; vegetation selection and management for overland flow systems; growing trees on effluent irrigatin sites with sand soils in the Upper Midwest; tree seedling responses to wastewater irrigation on a reforested old field in Southern Michigan; land application in Southern Michigan; and, plant disesases associated with municipal wastewater irrigation. (See W88-02742 thru W88-02753) (Geiger-PTT)
W88-02741

CURRENT STATUS ON THE SELECTION AND MANAGEMENT OF VEGETATION FOR SLOW RATE AND OVERLAND FLOW APPLICATION SYSTEMS TO TREAT MUNICIPAL WASTEWATER IN THE NORTH CENTRAL REGION OF THE UNITED STATES,
Gifford Pinchot National Forest, Vancouver, WA.
D. G. Brockway, T. M. Burton, J. H. Cooley, F. M. D'Itri, and R. H. Dowdy.
IN: Land Treatment of Municipal Wastewater: Vegetation Selection and Management. Ann Arbor Science, Ann Arbor, MI. 1982. p 5-18.

Descriptors: *Wastewater disposal, *Land disposal, *Wastewater irrigation, *Vegetation effects, *Wastewater renovation, *Wastewater treatment, Municipal wastewater, Nitrogen removal, Crop production, Forages, Overland flow, Corn, Forest watersheds.

Results of several major research projects in the north central region of the United States have been used to formulate guidelines to improve present wastewater renovation and vegetation management concepts. The selection of land treatment relative to other methods depends on the size of the community and the expertise of local system operators, as well as the cost, quantity, and type of land available. Spray irrigation has been the most common land treatment method adopted in the north central United States. During the application of high nitrogen wastewater, actively growing vegetation with a well developed root biomass is required if nitrate-nitrogen leaching is to be significantly reduced. A regional approach is essential to select and manage vegetation at land treatment facilities. The overland flow process holds great promise in treating municipal wastewater because vegetation can perform multiple functions such as controlling erosion, delaying runoff, entrapping solids, and removing nutrients by plant uptake. Row crops such as corn are attractive because of their potentially high rate of economic return as grain or silage. The tradeoff between good renovation and a cash return can best be attained by mixing corn and forage crops. Grasses or old fields offer the possibility of minimum management because they remove nitrogen from high nitrogen water even when left unharvested. Research needs for slow rate and overland flow systems are discussed. The use of forest watersheds for wastewater renovation projects is examined. Research needs for forested systems are suggested. (See also W88-02741) (Geiger-PTT)
W88-02742

SELECTION OF IRRIGATION SYSTEM DESIGN,
Williams and Works, Grand Rapids, MI.
J. C. Sutherland, and E. A. Myers.
IN: Land Treatment of Municipal Wastewater: Vegetation Selection and Management. Ann Arbor Science, Ann Arbor, MI. 1982. p 19-34, 1 fig, 1 tab, 23 ref.

Descriptors: *Irrigation design, *Land disposal, *Wastewater irrigation, *Vegetation, *Infiltration, Overland flow, Site selection, Wastewater treatment, Spray irrigation, Wastewater renovation, Forages, Grasses, Legumes, Soil-water-plant relationships.

The type of irrigation system to be selected depends on the quality of wastewater to be irrigated, restrictions on the quality of renovated wastewater leaving the site, and the characteristics of the site. The major site considerations affecting irrigation system choices are centered on soil, groundwater, and climate factors. Rapid infiltration, overland flow, and slow rate processes each need to be considered when choosing a specific land treatment type for any municipality. Slow rate process systems, surface application systems, and spray irrigation systems are described. Corn (for silage or for grain) and non-legume grasses are frequently grown under the slow rate process. The surface water technologies of overland flow and wetland flow are described in detail. The degree of slope used in successful overland flow applications has ranged from less than 2 to around 8%. Surface soils capable of supporting a close growing cover of water resistant grasses are potentially suitable for overland flow. Factors affecting winter wastewater irrigation operations are examined. Soil temperatures below 4 degrees are found to significantly inhibit the BOD and nitrogen removal mechanisms of plants. (See also W88-02741) (Geiger-PTT)
W88-02743

WASTEWATER CROP MANAGEMENT STUDIES IN MINNESOTA,
Minnesota Univ., St. Paul. Agriculture Extension Service.
R. H. Dowdy, C. E. Clapp, G. C. Marten, D. R. Linden, and W. E. Larson.
IN: Land Treatment of Municipal Wastewater: Vegetation Selection and Management. Ann Arbor Science, Ann Arbor, MI. 1982. p 35-47, 1 fig, 5 tab, 13 ref.

Descriptors: *Soil-water-plant relationships, *Wastewater irrigation, *Land disposal, *Water pollution effects, *Wastewater disposal, *Vegetation, Wastewater renovation, Forages, Corn, Grasses, Water quality, Wastewater composition, Nitrogen removal, Phosphorus removal, Sprinkler irrigation, Wastewater treatment.

Studies were carried out in Minnesota to test the effects of vegetation cover on silt loam soil on the land disposal of a secondarily-treated municipal wastewater. Effluent was sprinkler irrigated on corn and forages at rates of about 5 (low) and 10 (high) cm/week throughout the growing season. Each corn block was split in such a way that the effects of residue return or removal, tillage operations, and two different hybrids could be evaluated. The efficiency of the various treatments with respect to wastewater renovation was evaluated by determining the quality of soil water that percolated through the soil profile. Chemical analyses of water and effluent samples included total nitrogen and phosphorus as well as ammonium, nitrate, phosphate, chloride, and various cations. Dry matter yields of corn fodder varied from year to year on all treatments. Total nitrogen uptake by reed canarygrass was consistently higher than that by corn irrigated with effluent. The concentration of inorganic nitrogen in soil water was lower under grass cropping than under corn cropping. Phosphorus removal from the applied wastewater was essentially complete. Extrapolation of these data to other sites must be done with caution because many of the study parameters are interdependent. (See also W88-02741) (Geiger-PTT)
W88-02744

CROP MANAGEMENT STUDIES AT THE MUSKEGON COUNTY MICHIGAN LAND TREATMENT SYSTEM,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
B. G. Ellis, A. E. Erickson, L. W. Jacobs, and B. D. Knezek.
IN: Land Treatment of Municipal Wastewater: Vegetation Selection and Management. Ann Arbor Science, Ann Arbor, MI. 1982. p 49-64, 5 fig, 6 tab, 4 ref.

Descriptors: *Soil-water-plant relationships, *Crop production, *Wastewater irrigation, *Wastewater disposal, *Vegetation, Nitrogen removal, Land disposal, Wastewater renovation, Forages, Corn, Grasses, Wastewater composition, Wastewater treatment, Nitrates.

Cropping systems for the management of nitrogen under wastewater application were examined at the Muskegon County Michigan Land Treatment System. Treatments made to sandy soils were designed to compare a cash crop (corn), a cast crop-forage (corn-rye or corn-oats), and forage (rye grass) for their effectiveness in stripping nutrients, particularly nitrogen, from wastewater. The wastewater being applied to the fields was sampled both at the spray nozzles during the application of wastewater and by collection vessels placed within the treatment areas. Results showed that corn alone only removes nitrogen effectively during a relatively short period of the growing season in mid-summer. Forages, such as ryegrass, are effective in removing nitrogen during a much longer period of time. Corn may still be grown as a cash crop and the nitrogen removed by use of cover crops if an intercropping system is utilized to allow the intercrop to take up nitrogen during the period while corn is being established. Obtaining the correct kill of the intercrop is difficult but critical if a system is to be maintained that will remove nitrogen for most of the period in which wastewater is applied and at the same time obtain a good yield of corn. Accomplishing this is particularly difficult if corn must be planted during adverse conditions (i.e., windy days). (See also W88-02741) (Geiger-PTT)
W88-02745

COMPARISON OF THE CROP MANAGEMENT STRATEGIES DEVELOPED FROM STUDIES AT PENNSYLVANIA STATE UNIVERSITY, UNIVERSITY OF MINNESOTA, MICHIGAN STATE UNIVERSITY, AND THE MUSKEGON COUNTY LAND TREATMENT SYSTEM,
Georgia Coastal Plain Experiment Station, Tifton.
J. E. Hook.
IN: Land Treatment of Municipal Wastewater: Vegetation Selection and Management. Ann Arbor Science, Ann Arbor, MI. 1982. p 65-78, 15 ref.

Descriptors: *Crop production, *Wastewater irrigation, *Corn, *Comparison studies, *Wastewater renovation, Soil-water-plant relationships, Crop yield, Nitrogen removal, Forages, Grasses, Leaching, Land disposal, Wastewater disposal, Vegetation effects.

Comparisons were made of four wastewater renovation projects conducted between 1960 and 1980 by the Pennsylvania State University, the University of Minnesota, Michigan State University, and the Muskegon County Land Treatment System. Despite differences in soils, climate, wastewater strengths, and crop studies, the responses of the soil-crop systems to wastewater irrigation were generally similar. Corn was capable of producing reasonable grain yields when nitrogen applications in the wastewater or in supplemental fertilization was high enough. However, corn was effective in preventing nitrogen leaching for only a short period each year. Intercropping with rye and forages improved the wastewater renovation, but a difficult balance between corn and forage must be managed to obtain both goals. Perennial forages were very effective in preventing nitrogen leaching. Several adapted species are available for this purpose. Cutting management of the forage affects stand survival and production of the forage. (See also W88-02741) (Geiger-PTT)
W88-02746

MANAGEMENT STUDIES OF ANNUAL GRASSES AND PERENNIAL LEGUMES AND GRASSES AT THE MICHIGAN STATE UNIVERSITY WATER QUALITY MANAGEMENT FACILITY,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
M. B. Tesar, B. D. Knezek, and J. E. Hook.
IN: Land Treatment of Municipal Wastewater: Vegetation Selection and Management. Ann Arbor Science, Ann Arbor, MI. 1982. p 79-105, 8 fig, 6 tab, 22 ref.

Descriptors: *Wastewater irrigation, *Nitrogen removal, *Grasses, *Forages, *Legumes, Land dis-

posal, Nitrates, Wastewater renovation, Alfalfa, Sudangrass, Corn, Sorghum, Leaching, Orchardgrass, Wastewater treatment, Water quality.

Experiments were conducted at the Michigan State University water Quality Management Facility to determine which perennial legume and grass forage crops will produce high yields suitable for livestock, to determine the ability of soil and plants to remove minerals from sewage effluent applied in perennial forage crops and annual crops, and to determine the effectiveness of perennial grasses, perennial legumes, and annual grasses in removing nitrogen from effluent and how the removal affects nitrates in the soil water at varying depths. Results showed that the highest yields were produced by the annual grasses such as corn, forage sorghum, and sorghum sudangrass. Six alfalfa cultivars yielded twice as much as the best perennial grass (tall fescue) at the low (2.5 cm) and medium level (5.0 cm) of weekly effluent and nearly as much (10.31 ton/ha) as tall fescue (11.03 ton/ha) at the high level (7.5 cm) of effluent. Agate alfalfa (a nitrogen fixing legume) had the highest amount of nitrogen in the plant tissue. Reed canarygrass had the greatest amount of nitrogen in the plant tissue of all perennial and annual grasses at all three effluent rates. Orchardgrass is first choice of the perennial grasses for renovating wastewater. It removed nitrogen from the wastewater nearly as well as canarygrass but is much more widely used and accepted as an animal feed than is reed canarygrass which is not popular with livestock farmers. A mixture of alfalfa and orchardgrass is recommended on soils which are not naturally well drained. Tall fescue would be second choice after orchardgrass. (See also W88-02741) (Geiger-PTT)
W88-02747

OLDFIELD MANAGEMENT STUDIES ON THE WATER QUALITY MANAGEMENT FACILITY AT MICHIGAN STATE UNIVERSITY,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
T. M. Burton, and J. E. Hook.
IN: Land Treatment of Municipal Wastewater: Vegetation Selection and Management. Ann Arbor Science, Ann Arbor, MI. 1982. p 107-133, 11 fig, 5 tab, 11 ref. OWRT Grant No. A-091-MICH and EPA Grant No. R005143-01.

Descriptors: *Wastewater irrigation, *Wastewater disposal, *Nitrogen removal, *Phosphorus removal, *Wastewater renovation, Leaching, Biomass, Leachates, Wastewater treatment, Soil-water-plant relationships, Forages, Grasses, Vegetation effects, Spray irrigation.

The use of abondoned farm fields (oldfields) for tertiary treatment of secondary municipal wastewater was investigated on the Water Quality Management facility at Michigan State University from 1975 through 1980. The purpose of these studies was to determine if spray irrigation on oldfields was a reasonable means of achieving tertiary treatment; and, if so, what the best plan of operation would be to achieve maximal renovation per unit area of oldfield. A mass balance approach was used to investigate removal of nitrogen and phosphorus by the oldfield under various levels of irrigation and harvest or mowing during the growing season. Changes in the plant community resulting from these various treatments was monitored in detail. Feasibility of winter irrigation was investigated. Mass balances constructed for the oldfield plot studies demonstrated that oldfields are capable of preventing excessive losses of inorganic nitrogen. About 99% of applied phosphorus was retained onsite for the unharvested plots. The unharvested vegetation responded to wastewater irrigation by producing more biomass in each of the three seasons of irrigation while the non-irrigated areas produced less biomass in 1976 and 1977 than in the wetter year of 1975. The effects of wastewater irrigation appeared to be additive with more biomass produced in each succeeding year for the 5 cm/week area. Litter biomass decreased on the irrigated plots the first two years compared to the non-irrigated plots but the increased production of 1976 resulted in higher initial litter biomass in 1977. Mowing prolongs the period of active plant uptake of nitrogen and phosphorus. (See also W88-02741) (Geiger-PTT)
W88-02748

GROWING TREES ON EFFLUENT IRRIGATION SITES WITH SAND SOILS IN THE UPPER MIDWEST,
North Central Forest Experiment Station, East Lansing, MI.
J. H. Cooley.
IN: Land Treatment of Municipal Wastewater: Vegetation Selection and Management. Ann Arbor Science, Ann Arbor, MI. 1982. p 155-164, 3 tab, 15 ref.

Descriptors: *Wastewater disposal, *Wastewater irrigation, *Cottonwood trees, *Wastewater renovation, *Nutrient removal, Wastewater treatment, Leachates, Biomass, Trees, Sprinkler irrigation, Land disposal.

Highlights of research results that pertain to selecting and managing trees on effluent application sites are presented. Nitrate leaching is not likely to be as limiting with oxidation pond effluent as with mechanical treatment plant effluent. Several species and hybrids of cottonwoods seem ideally suited for effluent irrigation sites. Existing stands have responded variably to irrigation. Christmas tree crops can be grown under moving overhead sprinkler systems such as the center pivot irrigator. Effluent can also be used to increase growth rate in stands of naturally occurring regeneration or plantations of indigenous species. Weed control is essential for establishing hybrid poplar or conifer plantations on sites irrigated wth effluent. If irrigated trees show symptoms of nutrient deficiencies, supplemental mineral nutrients should be added to the irrigation water or directly to the site. (See also W88-02741) (Geiger-PTT)
W88-02750

TREE SEEDLING RESPONSES TO WASTEWATER IRRIGATION ON A REFORESTED OLD FIELD IN SOUTHERN MICHIGAN,
Michigan Dept. of Natural Resources, Lansing. Water Quality Div.
D. G. Brockway.
IN: Land Treatment of Municipal Wastewater: Vegetation Selection and Management. Ann Arbor Science, Ann Arbor, MI. 1982. p 165-179, 5 tab, 15 ref. OWRT Project No. A-086-MICH.

Descriptors: *Wastewater irrigation, *Wastewater disposal, *Land disposal, *Trees, *Wastewater renovation, Nutrient removal, Nitrogen removal, Phosphorus removal, Conifers, Soil-water-plant relationships.

During the seven years following establishment, a conifer-hardwood plantation planted on an old field site in southern Michigan was irrigated with 51 mm of municipal wastewater per week. The suitability of the planted tree species for use in reforesting old field sites under wastewater irrigation was evaluated based upon growth, survival, and nutrient assimilation performance. Eastern cottonwood was found to exhibit superior growth and nutrient assimilation responses to irrigation and is highly recommended for this cultural use. White ash, Scotch pine, tulip poplar, and black walnut exhibited good performance under irrigation and are also recommended. Norway spruce and white spruce were found to be marginal in the above performance categories and while not recommended for use on irrigated old field sites, may prove useable on other forest sites under irrigation. Black cherry and northern red oak exhibited survival and growth rates negatively related to irrigation treatment and are not recommended for reforestation of old field sites irrigated with municipal wastewater. The old field study site provided adequate water renovation, removal of nitrate-nitrogen, and total nitrogen approximating 85% and removal of phosphorus exceeding 98%. These values were similar to those reported for an unforested old field, underscoring the importance of grasses and associated herbs in renovating land-applied wastewater where planted seedlings have not yet fully occupied the site. As seedling root systems develop toward more complete site occupancy, a greater proportion of wastewater renovation may be attributed to the trees. (See also W88-02741) (Author's abstract)
W88-02751

STUDIES OF LAND APPLICATION IN OLD GROWTH FORESTS IN SOUTHERN MICHIGAN,
Michigan State Univ., East Lansing. Dept. of Zoology.
T. M. Burton.
IN: Land Treatment of Municipal Wastewater: Vegetation Selection and Management. Ann Arbor Science, Ann Arbor, MI. 1982. p 181-193, 4 tab, 11 ref.

Descriptors: *Wastewater disposal, *Land application, *Forests, *Wastewater irrigation, *Spray irrigation, Wastewater renovation, Vegetation effects, Nutrient removal, Nitrogen removal, Phosphorus removal, Forest management, Litter.

The use of late successional second-growth forests in southern Michigan for renovation and recharge of secondary municipal wastewater was studied on the Water Quality Management Facility at Michigan State University from 1976 through 1980. The objectives of these studies were to ascertain if such forests were capable of removing enough phosphorus and nitrogen from wastewater to achieve treatment equivalent to tertiary treatment by more conventional, mechnical means, to establish best management procedures for spray irrigation of such forests in Michigan if irrigation proved feasible, and to measure changes in the vegetation that might result from spray irrigation. Mass balance studies for the first three years of the experiment showed that older forests on well drained soils removed little, if any, nitrogen from secondary municipal wastewater. The feasibilty of wastewater irrigation with low nitrogen wastewater from wastewater lagoon systems was studied. Results demonstrated that, since the site provided excellent phosphorus removal during the first three years of the study, wastewater from a lagoon system with low nitrogen and high phosphorus should receive excellent renovation if sprayed on these older forests. If the irrigation rate is limited to the hydraulic capacity of the soil or to 5 cm/week or less, no significant impacts on vegetation growth or community structure should occur. (See also W88-02741) (Geiger-PTT)
W88-02752

PLANT DISEASES ASSOCIATED WITH MUNICIPAL WASTEWATER IRRIGATION,
Michigan State Univ., East Lansing. Dept. of Botany and Plant Pathology.
For primary bibliographic entry see Field 2I.
W88-02753

HAZARDOUS WASTE MANAGEMENT, VOLUME I: THE LAW OF TOXICS AND TOXIC SUBSTANCES.
CRC Press, Inc., Boca Raton, Florida. 1986. 207 p. Edited by George S. Dominquez and Kenneth G. Bartlett.

Descriptors: *Hazardous materials, *Waste management, *Waste disposal, *RCRA, *Legislation, *Legal aspects, Toxins, Toxicity, Regulations, Solid waste disposal, Wastewater disposal, Waste treatment, Radioactive wastes, Organic compounds, Pesticides, Wastewater treatment, Economic aspects, Recycling.

This guide book is intended to provide working managers with a comprehensive introduction to practical operational aspects of hazardous waste management and a foundation in revelant laws, rules, and regulations. The introductory chapter gives a brief overview of hazardous waste management. Chapter 2 discusses the constitutional framework of hazardous waste legislation. Chapter 3 briefly reviews some remedial options in hazardous waste management. Chapter 4 deals with the legislative history of the Resource Conservation and Recovery Act of 1976 (RCRA). Chapter 5 examines the RCRA and its amendments. The hazardous waste management program under the RCRA

is described in Chapter 6. Chapter 7 considers the legal development of remedies of hazardous waste victims and common law remedies. Statutory remedies to resolve legal problems involving hazardous waste victims are examined in Chapter 8. Economic issues and aspects of hazardous waste management are presented in Chapter 9. (See W88-02755 thru W88-02763) (Geiger-PTT)
W88-02754

HAZARDOUS WASTE MANAGEMENT,
Synthetic Organic Chemical Manufacturers Association, Inc., Washington, DC.
G. S. Dominguez.
IN: Hazardous Waste Management, Volume I: The Law of Toxics and Toxic Substances. CRC Press, Inc., Boca Raton, Florida. 1986. p 1-10, 3 tab.

Descriptors: *Hazardous materials, *Waste management, *Waste disposal, *RCRA, *Waste recovery, *Waste treatment, Wastewater treatment, Recycling, Wastewater composition, Legal aspects, Industrial wastes, Waste characteristics, Waste storage, Management planning.

A broad overview and introduction to the identification and classification of hazardous wastes are presented as well as some practical considerations inherent in the development of a hazardous waste program. There is a national as well as an international dimension to the problem of hazardous waste management. The primary sources of hazardous wastes from industry, municipal sources, hospitals, land reclamation, nuclear resources, and agriculture are examined. Some major areas of consideration in hazardous waste management are generation, storage, treatment, disposal, and transportation of hazardous materials. Waste characterization, treatment, and disposal options are briefly presented. Reuse, recycle, and recovery options are compared. Low- and non-waste technology is examined. The various waste management programs available are listed. (See also W88-02754) (Geiger-PTT)
W88-02755

CONSTITUTIONAL FRAMEWORK OF HAZARDOUS WASTE LEGISLATION,
For primary bibliographic entry see Field 6E.
W88-02756

REMEDIAL OPTIONS IN HAZARDOUS WASTE MANAGEMENT - AN OVERVIEW,
EWK Consultants, Inc., Washington, DC.
E. W. Kleppinger.
IN: Hazardous Waste Management, Volume I: The Law of Toxics and Toxic Substances. CRC Press, Inc., Boca Raton, Florida. 1986. p 41-49.

Descriptors: *Hazardous materials, *Waste management, *Cost-benefit analysis, *Waste disposal, *RCRA, *Water law, Waste dumps, Leachates, Incineration, Public health, Regulations, Risks, Economic aspects.

While there are a variety of technologies which can be used to handle hazardous waste situations, six basic combinations of remedial strategies are available. On-site or off-site measures can allow leakage of the waste products into the environment, contain the wastes, or treat or detoxify the hazardous materials, usually by incineration. Before implementing remedial options, standards defining what is acceptable or non-toxic must be established. The cost-effectiveness of the proposed remedial action should be examined. Two general strategies for dealing with hazardous waste litigation are discussed. The passive strategy allows organized opposition to develop to aid in the decision making process. In the aggressive strategy, the hazardous waste situation is controlled before it is allowed to get worse. Managing the problem aggressively requires the close cooperation of the legal profession and those who have technical expertise in the various disciplines to analyze and resolve the hazardous waste problem. Some cases illustrating the adoption of the aggressive strategy are examined. (See also W88-02754) (Geiger-PTT)
W88-02757

FROM CRADLE TO GRAVE: THE LEGISLATIVE HISTORY OF RCRA,
Davis, Graham and Stubbs, Washington, DC.
For primary bibliographic entry see Field 6E.
W88-02758

SUMMARY AND ANALYSIS OF THE RESOURCE CONSERVATION AND RECOVERY ACT OF 1976, AS AMENDED,
Cleary, Gottlieb, Steen and Hamilton, Washington, DC.
For primary bibliographic entry see Field 6E.
W88-02759

HAZARDOUS WASTE MANAGEMENT PROGRAM UNDER THE RESOURCE CONSERVATION AND RECOVERY ACT.
Cleary, Gottlieb, Steen and Hamilton, Washington, DC.
For primary bibliographic entry see Field 6E.
W88-02760

LEGAL DEVELOPMENT OF REMEDIES FOR TOXIC TORT PLAINTIFFS - COMMON LAW REMEDIES,
Environmental Law Inst., Washington, DC.
For primary bibliographic entry see Field 6E.
W88-02761

LEGAL DEVELOPMENT OF REMEDIES OF HAZARDOUS WASTE VICTIMS - STATUTORY REMEDIES,
For primary bibliographic entry see Field 6E.
W88-02762

ECONOMIC ISSUES AND ASPECTS OF HAZARDOUS WASTE MANAGEMENT,
ICF, Inc., Washington, DC.
G. Langner, S. Bailey, D. Bruce, and R. Rodensky.
IN: Hazardous Waste Management, Volume I: The Law of Toxics and Toxic Substances. CRC Press, Inc., Boca Raton, Florida. 1986. p 183-191.

Descriptors: *Economic aspects, *Waste management, *Hazardous materials, *RCRA, *Liability, *Costs, Waste disposal, Waste dumps, Waste storage, Regulations, Permits.

The role of the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) in regulating the cost liability connected with hazardous wastes is examined. RCRA emphasizes prevention rather than cleanup. RCRA created a new permit program covering every hazardous waste disposal site, and formulated a system to track every load of hazardous waste from generation at a plant to ultimate disposal. CERCLA established a trust fund to finance cleanups of abandoned hazardous waste sites and ongoing emergency releases. Compliance with RCRA hazardous waste regulations has resulted in an increase in costs to most firms in one or more of the following areas: costs of increased administrative burdens; costs of upgrading facilities; cost of avoiding expensive facility upgrades; and, costs of off-site management. RCRA requirements applicable to treatment, storage, and disposal facilities can be classified under four broad categories: technical design standards, financial responsibility requirements, permitting requirements, and paperwork and adminstrative requirements. CERCLA provides an extensive liability scheme for persons responsible for the release or certain threatened releases of hazardous substances into the environment. RCRA does not establish a commensurate liability scheme; it provides a narrower range of remedies, applies generally to fewer substances, and is available in a narrower range of situations. Future changes in RCRA, CERCLA, and the Post-Closure Fund will likely incur further liabilty costs to the owners and operators of hazardous waste facilities. (See also W88-02754) (Geiger-PTT)
W88-02763

FLOW EQUATIONS IN TERMS OF PIEZOMETER LEVELS FOR NONISOTHERMAL FLUID IN LOW-PERMEABILITY POROUS MEDIUM,
Rockwell International, Richland, WA. Rockwell Hanford Operations.
A. H. Lu, B. Sagar, R. B. Guenther, and R. T. Hudspeth.
Water Resources Research WRERAQ, Vol. 23, No. 6, p 1097-1102, June 1987. 3 fig, 2 tab, 14 ref. USDE Contract DE-AC06-77RL01030.

Descriptors: *Radioactive waste disposal, *Groundwater movement, *Path of pollutants, *Model studies, *Nonisothermal fluids, *Flow equations, *Mathematical models, *Data interpretation, Basalts, Underground waste disposal, Waste disposal, Mathematical studies, Mathematical equations, Porous media, Piezometry.

The Basalt Waste Isolation Project is investigating deep basalt flows for the disposal of high-level nuclear wastes. The time spans of interest are so long that site performance must be projected by mathematical modeling. At great depths, velocity potentials determined simply by using the gradients of piezometric levels (i.e., neglecting the temperature dependence) may cause some errors. Therefore, flow equations are written in terms of the piezometric level as the dependent variable, so that model input and output are in terms of directly measured field data. For nonisothermal flow, a nonlinear governing equation is obtained. Under certain assumptions on the functional representation of fluid density, a scalar potential can be defined. A simple example is presented to demonstrate the methodology to obtain such a potential. Improvement in calculating the downhole pressures from water level data is also discussed. (Author's abstract)
W88-02788

METHODS OF IMMOBILIZING SOIL CONTAMINATION (METHODEN ZUR IMMOBILISIERUNG VON BODENKONTAMINATIONEN),
Envi-Sann G.m.b.H., Schmitten (Germany, F.R.).
For primary bibliographic entry see Field 5G.
W88-02814

NUTRIENT REMOVAL FROM EFFLUENTS BY AN ARTIFICIAL WETLAND: INFLUENCE OF RHIZOSPHERE AERATION AND PREFERENTIAL FLOW STUDIED USING BROMIDE AND DYE TRACERS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Centre for Irrigation Research.
For primary bibliographic entry see Field 5D.
W88-02830

ROLE OF WOODY VEGETATION IN PREVENTING GROUND WATER POLLUTION BY NITROGEN FROM SEPTIC TANK LEACHATE,
Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
For primary bibliographic entry see Field 5D.
W88-02832

FLUID FLOW IN CRYSTALLINE ROCKS: RELATIONSHIPS BETWEEN GROUNDWATER SPRING ALIGNMENTS AND OTHER SURFACE LINEATIONS AT ALTNABREAC, UNITED KINGDOM,
British Geological Survey, Keyworth (England).
For primary bibliographic entry see Field 2F.
W88-02834

PRELIMINARY BOUNDS ON THE EXPECTED POSTCLOSURE PERFORMANCE OF THE YUCCA MOUNTAIN REPOSITORY SITE, SOUTHERN NEVADA,
Sandia National Labs., Albuquerque, NM.
S. Sinnock, Y. T. Lin, and J. P. Brannen.
Journal of Geophysical Research JJGBDU, Vol. 92, No. B8, p 7820-7842, July 1987. 20 fig, 6 tab, 30 ref.

Descriptors: *Path of pollutants, *Groundwater, *Waste disposal, *Underground waste disposal, *Unsaturated zone, *Radioactive waste disposal, Geochemistry, Radionuclides, Water table.

On the basis of current data and understanding of site characteristics at Yucca Mountain, the likely performance range of a mined repository for spent nuclear fuel can be calculated. Low flux through the unsaturated zone results in groundwater travel times to the water table that probably exceed 10,000 years and may exceed 100,000 years, far longer than required by the Nuclear Regulatory Commission (NRC). The low flux will also limit releases of waste from the waste packages, probably to annual amounts less than one millionth of the mass of the waste inventory remaining 1000 years after repository closure; the corresponding releases of curies would be well within the allowable releases set by the NRC. Geochemical retardation by sorption and diffusion will slow radionuclide movement relative to groundwater flow by factors of hundreds to thousands for many waste species. In combination, these site conditions provide a high degree of confidence that no releases to the accessible environment will occur during the first 10,000 years after repository closure, the time period for which the Environmental Protection Agency (EPA) has set release limits. Carbon 14, technetium 99, iodine 129, and various nuclides of uranium sorb poorly on the tuffs along the flow paths and, together with uranium daughter products, will be the first radionuclides to arrive at the water table. The total radioactivity produced by these and later arriving contaminants will remain far below the allowable releases, even for periods of millions of years, if expected flux conditions prevail. If the flux is currently greater than the values inferred from the measured in situ moisture contents of the volcanic rocks or if it were to increase in the future, fracture flow and attendant short flow times to the water table could occur. Even if rapid fracture into the rock matrix would ensure slow migration of most of the wastes through the sorbing matrix. (Author's abstract)
W88-02835

HYDROLOGICAL PROPERTIES OF TOPOPAH SPRING TUFF: LABORATORY MEASUREMENTS,
Lawrence Livermore National Lab., CA.
W. Daily, W. Lin, and T. Buscheck.
Journal of Geophysical Research JJGBDU, Vol. 92, No. B8, p 7854-7864, July 1987. 6 fig, 3 tab, 16 ref. DOE Contract W-7405-ENG-48.

Descriptors: *Geologic fractures, *Topopah Spring, *Path of pollutants, *Underground waste disposal, *Groundwater, *Waste disposal, *Radioactive waste disposal, Geochemistry, Radionuclides, Pore water.

The transport of water (both the liquid and vapor phases) in tuff from the Topopah Spring welded unit under conditions expected in the near-field environment of a high-level nuclear waste container was studied. A naturally fractured sample of Topopah Spring tuff (approximately 8 cm in diameter and 10 cm long) from Yucca Mountain at the Nevada Test Site, Nevada, was studied using, as a pore fluid, natural groundwater recovered from a well in which the principal producing horizon is the Topopah Spring Member. Confining pressure, sample temperature, and pore pressure were held at values that simulate expected in situ near-field conditions shortly after emplacement of the container. The results are comparable with results from previous experiments on 2.54-cm-diameter samples of Topopah Spring tuff. During the more than 6-month experiment duration, water permeability decreased about 3 orders of magnitude. The most rapid measured permeability change (between about 600 and 100 microdarcy) occurred when the sample temperature was increased from room temperature to 89 C. Water permeability decreased in a fairly monotonic manner to about 1 microdarcy. This behavior probably resulted from a decrease in the aperture of the natural fracture, possibly reflecting transport and redeposition of silica (which was already present in the fracture). This process also resulted in a weak bonding of the sample halves. Previous experiments on two smaller naturally fractured Topopah tuff samples resulted in fracture healing presumably by the same mechanism. The degree of healing, indicated by bonded tensile strength and change in fluid permeability, seems to be sample dependent. The distribution of electrical resistivity indicates that the sample dehydrates and rehydrates nonuniformly. This is consistent with the findings on smaller samples. Computed impedance tomographs indicate that during each of the five subsequent dehydrations of the sample, water first left the matrix adjacent to the fracture surface, then escaped the sample through the fracture aperture. Drying then progressed into the matrix around the fracture. Rehydration of the dry sample was not quite the reverse of the dehydration process. Water initially entered the fracture along the fracture edge, and the matrix was then wetted progressively from these points. However, the matrix was also wetted along paths apparently unrelated to fracture flow. (Author's abstract)
W88-02836

MAP SHOWING OUTCROPS OF THICK, DOMINANTLY ARGILLACEOUS SEDIMENTARY AND METASEDIMENTARY ROCKS, BASIN AND RANGE PROVINCE, SOUTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W88-02987

MAP SHOWING OUTCROPS OF BASALTIC ROCKS, BASIN AND RANGE PROVINCE AND VICINITY, TRANS-PECOS TEXAS,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W88-02993

MAP SHOWING OUTCROPS OF THICK, DOMINANTLY ARGILLACEOUS SEDIMENTARY ROCKS, BASIN AND RANGE PROVINCE, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 8E.
W88-02994

SUMMARY OF NORTHERN ATLANTIC COASTAL PLAIN HYDROLOGY AND ITS RELATION TO DISPOSAL OF NUCLEAR WASTE IN BURIED CRYSTALLINE ROCK,
Geological Survey, Raleigh, NC. Water Resources Div.
O. B. Lloyd, J. D. Larson, and R. W. Davis.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4146, 1985. 80 p, 23 fig, 4 tab, 39 ref.

Descriptors: *Geohydrology, *Aquifers, *Confining beds, *Groundwater movement, *Saline water, *Radioactive wastes, *Delaware, *Maryland, *New Jersey, *North Carolina, *Virginia, Northern Atlantic Coastal Plains.

Interpretation of available hydrologic data suggests that some areas beneath the Coastal Plain in the States of Delaware, Maryland, New Jersey, North Carolina, and Virginia might have some potential for the disposal of nuclear waste in crystalline rock that is buried beneath the Coastal Plain sediments. The areas of major interest occur where the top of the basement rock lies between 1,000 and 4,000 feet below sea level, the aquifer(s) immediately above the basement rock are saturated with saline water, confining material overlies the saline water bearing aquifer(s), and groundwater flow in the saline water aquifer(s) can be established. Preliminary data on (1) the distribution and thickness of the lowermost aquifers and confining beds, (2) the distribution of hydraulic conductivity in the lowermost aquifers, (3) estimated hydraulic heads and inferred direction of lateral groundwater flow for 1980, and (4) the distribution of saline water and brine, indicate eastern parts of the study area relatively best meet most of the criteria proposed for sediments that would overlie any potential buried crystalline-rock disposal site. (USGS)
W88-03020

EFFECTS OF HIGH-RATE WASTEWATER SPRAY DISPOSAL ON THE WATER-TABLE AQUIFER, HILTON HEAD ISLAND, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
G. K. Speiran.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4291, 1985. 31 p, 18 fig, 2 tab, 4 ref.

Descriptors: *Water quality, *Groundwater, *Wastewater disposal, *South Carolina, Hilton Head Island, Land disposal, Wastewater irrigation, Nutrient removal, Dissolved solids, Beaufort County.

A study by the U.S. Geological Survey from April 1982 through December 1983 evaluated the effects of high-rate disposal of treated wastewater on the water table aquifer, Hilton Head Island, South Carolina. Flooding of topographically low areas resulted from the application of 10.8 inches of wastewater in 10 days in January 1983. The water table remained 2-1/2 to 5-1/2 feet below land surface when wastewater was applied at rates of 5 inches per week in August and December 1983. (USGS)
W88-03065

LAND APPLICATION OF MUNICIPAL SEWAGE SLUDGE,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
H. A. Elliott.
Journal of Soil and Water Conservation JWSCA3, Vol. 41, No. 1, p 5-10, January-February 1986. 1 tab, 18 ref.

Descriptors: *Land disposal, *Sludge disposal, *Municipal wastewater, *Environmental protection, *Risks, *Cost-benefit analysis, Sludge, Wastewater, Benefits, Environmental control, Food chains, Fertility, Soil amendment, Fate of pollutants, Water pollution effects, Nutrients, Fertilizers, Environmental effects, Public health, Heavy metals, Monitoring, Environmental policy.

The relative risks, benefits, and costs are reviewed, for arriving at a policy to control and manage sludge spreading on land. Awareness of the agronomic and environmental impacts is essential to developing a sludge disposal program that is both cost-effective and protective of the food chain and of the environment. Topics discussed include impacts on soil fertility, environmental and health effects, alternative land-based options, management guidelines, and the outlook for the future. It is concluded that, based on current knowledge, the potential health and environmental risks can be minimized or abated with proper site selection, management, and monitoring. As new research information becomes available, the ability to assess and control these risks improves. It is imperative to recognize the provisional nature of existing regulations and to allow for reevaluation as the scope of knowledge broadens. (Doria-PTT)
W88-03206

TOXIC AND HAZARDOUS WASTES.
For primary bibliographic entry see Field 5D.
W88-03223

CONSIDERATIONS IN SELECTING A TRANSPORTABLE THERMAL DESTRUCTION UNIT (TTDU),
Illinois State Environmental Protection Agency, Springfield.
J. C. Reed, S. R. Strauss, and J. D. Cobb.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 187-197, 6

tab, 5 ref.

Descriptors: *Waste disposal, *Planning, *Incineration, *Project plans, *Hazardous materials, Evaluation, Illinois, Selection processes, Cleanup operations, Cleanup.

The background evaluation of mobile incineration technology as it was developed by the Illinois Environmental Protection Agency is presented. The evaluation tools and techniques that would be useful to others involved in toxic and hazardous waste cleanups to ensure the best treatment system with the lowest probability of foreseeable difficulties are detailed. Wood-PTT)
W88-03236

LOW TEMPERATURE THERMAL STRIPPING OF VOLATILE COMPOUNDS -- A FIELD DEMONSTRATION PROJECT,
Weston (Roy F.), Inc., West Chester, PA.
J. W. Noland, N. P. McDevitt, and D. L. Koltuniak.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 198-214, 5 fig, 1 tab.

Descriptors: *Waste disposal, *Thermal stripping, *Soil contamination, *Water pollution treatment, *Cleanup operations, *Groundwater pollution, *Water quality, Maryland, Volatile organic compounds, Organic compounds, Screw conveyor, Groundwater, Field tests.

The U.S. Army Toxic and Hazardous Materials Agency (ASATHAMA), located in the Aberdeen Proving Ground, Maryland, has responsibility for installation restoration and demilitarization of unserviceable or obsolete chemical agent munitions and for pollution abatement and environmental control technology development. As part of their research and development efforts, low temperature thermal stripping of volatile organic compounds from the soil was developed. If allowed to remain in the soil, the organic compounds would migrate to the underlying groundwaters and contaminate them. The innovative process uses a heated screw conveyor to volatilize the organics from the soil and an after burner for thermal destruction of the volatilized organics. Bench-scale studies of the thermal stripping concept identified the method as a feasible treatment process. A pilot-scale field demonstration of the process, using actual soil contaminated by volatile organic compounds was described. (See also W88-03223) (Wood-PTT)
W88-03237

IMPLEMENTATION STRATEGIES AND DESIGN CONCEPTS FOR APPLICATION OF SOLIDIFICATION/STABILIZATION TECHNOLOGY TO CONTAMINATED DREDGED MATERIAL,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
D. D. Ludwig, J. H. Sherrard, and J. M. Betteker.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 215-235, 8 fig, 21 ref.

Descriptors: *Dredging, *Waste disposal, *Hazardous materials, *Solidification, *Stabilization, *Wastewater treatment, Underwater disposal, Confined shoreline disposal, Land disposal, Leaching, Hydraulic dredging, Mechanical dredging, Economic aspects.

In response to the need to develop cost-effective methods for the disposal of contaminated dredged material, strategies which are state-of-the-art for improving the environmental quality of dredging and disposal operations are proposed. The four strategies presented include opportunities for underwater, confined shoreline, or landfill disposal and were based on the expectation that the dredged material would contain highly toxic compounds which must not be allowed to leach from the disposal area. Furthermore, the hydraulic and mechanical dredging methods which are proposed to minimize pollution due to dispersion during dredging. The disposal options detailed are: (1) hydraulic dredging with disposal in a confined disposal facility; (2) mechanical dredging with chemical solidification/stabilization in a confined disposal facility; (3) mechanical dredging with disposal in a prepared underwater site; and (4) mechanical dredging, chemical solidification with disposal in an on-land site. These strategies are proposed as cost-effective, although not inexpensive, methods of addressing the environmental hazards posed by contaminated material. (See also W88-03223) (Wood-PTT)
W88-03238

PREDICTION OF HEAVY METAL LEACHING RATES FROM STABILIZED/SOLIDIFIED HAZARDOUS WASTES,
New Hampshire Univ., Durham. Dept. of Civil Engineering.
P. L. Bishop.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 236-252, 3 fig, 3 tab, 22 ref.

Descriptors: *Waste disposal, *Hazardous materials, *Leaching, *Groundwater pollution, *Fate of pollutants, *Heavy metals, *Model studies, Mathematical models, Mathematical equations, Diffusion coefficient, Leaching rates, Leachates, Diffusion, Wastes.

A format is given for the prediction of the long-term fate of stabilized/solidified hazardous wastes placed in the environment. Data from multiple extraction leaching tests and from upflow column leaching tests indicate that metal leaching can be predicted using a diffusion-based model. Diffusion coefficients are not, however, constant with time; they generally increase with time as the waste becomes more porous and as the speciation of the metals changes to more soluble forms. The developed leaching prediction procedure takes these changes into consideration along with variations in waste particle size, leachant velocity, and leachant acidity. The data from this procedure can be used to provide a relative indication for adverse impacts on groundwater quality. (See also W88-03223) (Wood-PTT)
W88-03239

SOLIDIFICATION/STABILIZATION OF CONTAMINATED DREDGED MATERIAL,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W88-03240

ONE METAL FINISHING COMPANY'S EXPERIENCE WITH THE HAZARDOUS WASTE DELISTING PROCESS,
Whirlpool Corp., Benton Harbor, MI.
J. B. Gasiorowski, D. L. Haley, S. P. Willis, and P. S. Yancey.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 291-303, 2 fig, 7 tab, 6 ref.

Descriptors: *Waste disposal, *Hazardous materials, *Hazardous materials delisting process, *Heavy metals, *Sludge, *Metal-finishing wastes, *Industrial wastes, *Economic aspects, Nickel, Cyanide, Cadmium, Chromium, Metals, Industrial plants, Electroplating, Phosphate conversion, Sludge solids, Dewatering, Landfills.

In the production of major home appliances, Whirlpool Corporation generates several thousand tons/year of metal hydroxide sludges, produced as a result of the treatment of wastewater from various metal finishing processes at several manufacturing facilities in the Midwest, that must be disposed of in an approved manner. Regulations promulgated by the EPA in 1980 identified hazardous wastes by characteristics and by listings. Hazardous waste No. F006 applies to the wastewater sludges from electroplating, because the presence of cadmium, hexavalent chromium, nickel and cyanide were anticipated. While phosphate conversion coating and organic electro-deposition, as used in Whirlpool operations, are not normally thought of as conventional electroplating, the EPA verbally indicated that the dewatered solids from these procedures were also included in the F006 listing. When the interpretation was clarified in 1981, Whirlpool immediately changed disposal sites from the local landfills to the federally approved hazardous waste disposal facilities. However, based on their knowledge of the material, five Whirlpool plants petitioned the EPA to exclude their dewatered solids from inclusion as an F006 hazardous waste for reasons including reduced disposal costs, reduced long-term liability, improved employee and community relations, and better use of limited hazardous waste landfill capacity. (See also W88-03223) (Wood-PTT)
W88-03242

WASTE MANAGEMENT AND REGULATORY COMPLIANCE TECHNIQUES FOR PILOT SCALE CHEMICAL PRODUCTION,
Air Products and Chemicals, Inc., Allentown, PA.
K. B. Adams.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 304-321, 7 fig, 2 tab, 13 ref.

Descriptors: *Waste management, *Pilot plants, *Industrial wastes, *Chemical wastes, *Regulations, *Legal aspects, Regulatory compliance, Planning, Model studies, Decision making, Wastes.

Regulatory requirements and waste management planning in pilot scale chemical production often takes a secondary priority to technical issues and production schedules. A rigorous methodology identifying environmental/regulatory hurdles integrated into the experimental planning can, however, minimize regulatory delays and streamline waste management decision making. A regulatory checklist and waste management guidelines, presented as flowchart decision models, were developed to insure that the important environmental and regulatory concerns are addressed during the experimental planning process. It is suggested that water management decisions made during planning be reevaluated during production since the wastes generated may differ significantly in character and quantity from those predicted by preliminary lab-scale experiments. By incorporating the described methods into the planning and operational modes of pilot plant experimentation, regulatory delays and non-compliance penalties can be avoided. (See also W88-03223) (Wood-PTT)
W88-03243

POTENTIAL FOOD CHAIN EFFECTS FROM LAND APPLICATION OF SLUDGES,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5C.
W88-03248

ANALYSIS OF VIRUS 'DIE-OFF' IN LAND-APPLIED INDUSTRIAL WASTES AND SLUDGES,
Algal Research Center, Landenberg, PA.
M. P. Kraus.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 365-375, 4 fig, 5 tab, 4 ref.

Descriptors: *Land disposal, *Environmental effects, *Waste disposal, *Viruses, *Sludge disposal, *Cyanophages, *Water pollution effects, Cyanophyta, Genetic technology, Landfills, Assay, Wastewater quality, Industrial wastewater, Infection, Diseases, Sludge, Industrial wastes.

A lab-to-field study was based on a natural genetic technology for the rectification of landfills where sewage sludge and agricultural and industrial wastes were buried under the assumption that the soil would act as a filter and render the buried material harmless. The appearance of cyanophages in domestic sewage, and their correlation to stream deterioration as measured by biological diversity indices, indicates that 'mobile genetic elements' may provide for an intertaxonomic transfer of genetic determinants. Cyanophage/host assays were used in two ways: (1) to enumerate and identify the presence of cyanophages as an indicator of wastewater quality, and (2) to study the interactions taking place during the infectious cycle of the cyanophage on its host. The identification and enumeration data was used to compare die-off rates of cyanophages seeded into a number of different types of wastes while the study of the interactions was used to illustrate the influence of components of the various sludge materials which can alter genetic recombination or other controls during the infectious cycle. The die off of viruses in the various media and the die off mechanisms are summarized and discussed. (See also W88-03223) (Wood-PTT)
W88-03249

COMPARISON OF THE SORPTION/DESORPTION CAPACITY OF A SPENT OIL SHALE AND A WESTERN SOIL,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
A. N. Godrej, G. D. Boardman, and Y.-W. Lu.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 431-442, 7 fig, 3 ref. DOE Contract No. DE-AS20-82LC10964.

Descriptors: *Waste disposal, *Wastewater disposal, *Combined wastes, *Oil wastes, *Fate of pollutants, *Sorption, *Desorption, Oil shale, Industrial wastes, Shales, Industrial wastewater, Hazardous materials, Wastewater, Organic compounds.

When oil is extracted from oil shales, large quantities of spent shale and process (retort) waters are generated. Since the retort waters are contaminated by organic and inorganic agents which are derived from the spent shale, co-disposal of the two waste materials was considered. In order to evaluate the hazards associated with co-disposal and land disposal of the wastes, it is necessary to know about the sorption/desorption (S/D) behavior of agents contained in the shales and retort waters. Therefore, the S/D behavior of three organic agents, 2-hydroxynaphthalene (HN), 1,2,3,4-tetrahydroquinoline (THQ), and 2,3,5-trimethylphenol (TP), were evaluated in the presence of a spent shale and a western soil. Antrim shale proved to be a relatively good sorbent for HN and THQ, and a weaker one for TP. The western soil displayed reasonable sorptive capacity for HN and THQ, but had a considerably lower capacity for these compounds than Antrim shale. The results obtained with TP sorbing on the western soil were anomalous. (See also W88-03223) (Wood-PTT)
W88-03256

SITING POWER PLANT ASH DISPOSAL AREAS WITH HELP FROM THE LOCAL COMMUNITY,
Pennsylvania Power and Light Co., Allentown.
A. D. Spear.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 443-453.

Descriptors: *Waste disposal, *Coal ash, *Public participation, *Disposal site selection, Pennsylvania, Public relations, Attitudes, Social participation, Industrial wastes, Solid waste disposal, Land disposal, Disposal sites.

The Pennsylvania Power & Light Company found that working with the local communities continuously and as openly as possible created an awareness of each other's concerns and needs. The positive experiences siting ash disposal areas, particularly with respect to shorter permitting lag times and community acceptance, are summarized, and guidelines for the disposal area siting procedure including public participation presented. The five phases of each siting study, identification of suitable land, identification of potential sites, preliminary field investigations, site grading based on weighted criteria, and final site selection, are discussed along with suggestions for public participation milestones. (See also W88-03223) (Wood-PTT)
W88-03257

PUBLIC INVOLVEMENT IN ACCEPTABLE RISK DECISIONS,
ICF, Inc., Washington, DC.
M. Cox, and E. Blayney.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 454-461, 1 ref.

Descriptors: *Waste disposal, *Public participation, *Public relations, *Planning, *Decision making, Public opinion, Attitudes, Social participation, Social aspects, Public relations.

Because public dissatisfaction can and does stop government agencies from moving forward to implement unpopular programs, enforce unpopular laws, or exercise their authority to make necessary decisions on any controversial issue, involving the public in responsible decision-making is essential. Governmental interactions with the public and how these interactions affect the process of making decisions about acceptable risk for waste management and remedial programs are explored. It is stressed that the public involvement process should begin early with education and open and thorough discussion between government decision-makers and the public. Decision-making will not be easier with increased public participation, but the resulting decisions will be better and more durable. (See also W88-03223) (Wood-PTT)
W88-03258

STRATEGIES AND CHOICES IN PENNSYLVANIA'S HAZARDOUS WASTE FACILITIES PLAN,
Environmental Resources Management, Inc., West Chester, PA.
For primary bibliographic entry see Field 5D.
W88-03261

HAZARDOUS WASTE MINIMIZATION PLANNING AT THE ARMY MATERIEL COMMAND (AMC),
Army Materiel Development and Readiness Command, Alexandria, VA.
For primary bibliographic entry see Field 5D.
W88-03262

COMMUNITY PLANNING FOR SMALL-QUANTITY HAZARDOUS WASTE GENERATORS,
Boston Univ., MA. Dept. of Urban Affairs and Planning.
R. F. Anderson.
American Planning Assoc. Journal, Vol. 53, No. 1, p 104-111, Winter 1987. 5 tab, 7 ref.

Descriptors: *Hazardous wastes, *Waste management, *Hazardous materials, *Management planning, Community planning, Planning techniques, Waste disposal, Wastewater treatment, Industrial wastes, Industrial wastewater.

Only recently has the small-quantity generator of hazardous wastes come under federal or state regulation. The wastes produced by these generators, however, pose a serious threat to health and environmental resources in almost every community. Local planners should and can design preventative strategies to deal with management of these wastes. Such strategies should include problem assessment, education programs, technical assistance to generators, and revision of local land use policy to prohibit improper disposal practices. New information useful to planners in assessing the problem in their communities was presented and elements of a planning approach to control the small-quantity hazardous waste stream were suggested. (Author's abstract)
W88-03288

EFFECTS OF SANITARY SEWERS ON GROUNDWATER LEVELS AND STREAMS, NASSAU AND SUFFOLK COUNTIES, NEW YORK. PART 2--DEVELOPMENT AND APPLICATION OF SOUTHWEST SUFFOLK COUNTY MODEL,
Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03313

HYDROLOGIC-TEST DATA FROM WELLS AT HYDROLOGIC-TEST PADS H-7, H-8, H-9, AND H-10 NEAR THE PROPOSED WASTE ISOLATION PILOT PLANT SITE, SOUTHEASTERN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03400

SELECTED HYDROLOGIC DATA FROM A WASTEWATER SPRAY DISPOSAL SITE ON HILTON HEAD ISLAND, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03414

HYDROGEOLOGY, GROUND-WATER FLOW, AND TRITIUM MOVEMENT AT A LOW-LEVEL RADIOACTIVE-WASTE DISPOSAL SITE NEAR SHEFFIELD, ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03427

EVALUATION OF THE CENTRAL BASIN AQUIFER SYSTEM IN TENNESSEE FOR RECEIVING INJECTED WASTES,
Geological Survey, Nashville, TN. Water Resources Div.
M. W. Bradley.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4103, 1985. 23 p, 7 fig, 4 tab, 32 ref.

Descriptors: *Aquifer systems, *Injection wells, *Waste disposal wells, *Tennessee, *Underground Injection Control Program, Geohydrology, Contamination, Hydrocarbons, Water use, Water quality, Central basin.

An aquifer may be allowed to receive injected wastes where the aquifer meets criteria established in the Environmental Protection Agency's Underground Injection Control program. The Central Basin aquifer system in Tennessee consists of Ordovician to Devonian carbonate rocks and it occurs from the Valley and Ridge province to west of the Tennessee River. This aquifer system is currently used for drinking water in the Central Basin and western Highland Rim, but is not used for drinking water in the northern Highland Rim nor the Cumberland Plateau provinces. Part of the northern Highland Rim and the Cumberland Plateau, according to the Environmental Protection Agency's Underground Injection Control criteria, will not be used as a source of drinking water in the future and may be eligible to receive injected wastes. (USGS)
W88-03461

DETERMINATION OF DIFFUSIVITIES IN THE RUSTLER FORMATION FROM EXPLORATORY SHAFT CONSTRUCTION AT

THE WASTE ISOLATION PILOT PLANT SITE, SOUTHEASTERN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03466

GROWTH OF ESCHERICHIA COLI IN A PULP AND CARDBOARD MILL,
National Board of Waters, Helsinki (Finland).
R. M. Niemi, S. Niemela, J. Mentu, and A. Siitonen.
Canadian Journal of Microbiology CJMIAZ, Vol. 33, No. 6, p 541-545, June 1987. 3 tab, 37 ref.

Descriptors: *Growth, *Escherichia coli, *Pulp waste, *Coliforms, Effluents, Species composition, Pathogens, Bacteria.

The coliform flora of a pulp and cardboard mill that uses birch as the raw material and ammonium sulfate as the process chemical was studied. Escherichia coli was observed to multiply in the mill. It persisted as the dominant thermotolerant coliform in the effluent. Klebsiellae were encountered among total coliforms only. The E. coli strains isolated had the biochemical characteristics and maximum growth temperatures typical to the species. However, serotyping and hemolysin test differentiated these strains from pathogenic and fecal E. coli. (Author's abstract)
W88-03472

POTENTIAL FOR MIGRATION OF HAZARDOUS WOOD TREATING CHEMICALS DURING LAND TREATMENT OPERATIONS,
Mississippi State Univ., Mississippi State. Forest Products Utilization Lab.
For primary bibliographic entry see Field 5B.
W88-03484

5F. Water Treatment and Quality Alteration

HANDBOOK OF OZONE TECHNOLOGY AND APPLICATIONS.
For primary bibliographic entry see Field 5D.
W88-02503

HISTORICAL BACKGROUND, PROPERTIES AND APPLICATIONS,
Oklahoma State Univ., Stillwater. School of Chemical Engineering.
A. G. Hill, and R. G. Rice.
IN: Handbook of Ozone Technology and Applications. Volume 1. Ann Arbor Science, Ann Arbor, MI. 1982. p 1-37, 4 fig, 4 tab, 141 ref.

Descriptors: *Ozone, *Ozonation, *Wastewater treatment, *Water treatment, Drinking water, Potable water, Trihalomethanes, Chlorination, Oxidation, Biological oxygen demand, Municipal wastewater, Chemical oxygen demand, Japan, France, West Germany, Africa, Israel.

This chapter traces the development of ozone technology, from its discovery through its early applications, particularly in the areas of water and wastewater treatment. Ozone is used in the treatment of potable water supplies by employing ozone as the primary oxidant before chlorination. This will usually satisfy most of the oxidant demand of the water being treated, thus lowering the subsequent demand for chlorine and minimizing the unwanted side reactions of chlorination to produce chlorinated organic materials, such as trihalomethanes (THM). In municipal wastewater treatment, ozone has been studied primarily for disinfection (following primary of secondary treatment), but also for lowering of biological (BOD) and chemical oxygen demand (COD) levels, oxidation of ammonia, and removal of color, nutrients and suspended solids. Most of the disinfection work has been pioneered in the United States since the early 1970s, where it has been developed to the point of full-scale commercial use. A considerable amount of research has been conducted by the Japanese during the same period, especially for recycling of treated sewage effluents for nonpotable purposes in water-short regions of that country. More recently, French and German investigators have published results of pilot plant studies involving ozonation of municipal sewage. Israeli scientists have been studying the BAC process for treatment of sewage prior to ground recharge. In South Africa, ozonation has been shown to be cost-effective for extending the operating lifetimes of GAC columns used to remove dissolved organics from sewage being treated for potable reuse. The evolution of these and other studies are briefly reviewed. (See also W88-02503) (Lantz-PTT)
W88-02504

MASS TRANSFER OF OZONE INTO AQUEOUS SYSTEMS,
Mississippi State Univ., Mississippi State. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5D.
W88-02505

CONTACTING OF OZONE WITH WATER AND CONTACTOR OFFGAS TREATMENT,
Compagnie Intercommunale Bruxelloise des Eaux (Belgium).
For primary bibliographic entry see Field 5D.
W88-02506

RECENT EXPERIMENTAL STUDIES DEALING WITH CORROSION AND DEGRADATION OF MATERIALS IN OZONE-CONTAINING ENVIRONMENTS,
Union Carbide Corp., Tonawanda, NY. Linde Div.
For primary bibliographic entry see Field 8G.
W88-02507

ANALYSIS OF OZONE IN AQUEOUS SOLUTION,
North Carolina Univ., Chapel Hill.
For primary bibliographic entry see Field 5D.
W88-02508

INTERFERENCES BETWEEN OZONE AND CHLORINE,
Societe Degremont, Rueil-Malmaison (France).
Y. Richard, and L. Brener.
IN: Handbook of Ozone Technology and Applications. Volume 1. Ann Arbor Science, Ann Arbor, MI. 1982. p 277-284, 5 fig, 17 ref.

Descriptors: *Water treatment, *Ozone, *Chlorine, Chemical reactors, *Ozonation, *Disinfection, Taste, Odors, Color, Bacteria, Oxidation, Chlorine dioxide, Drinking water.

Ozone is the most powerful oxidizing and viricidal agent used in drinking water treatment. Its effects (elimination of organics, tastes, odors and color) have been described widely. In numerous cases, however, it has been observed that after post-ozonation treatment, nonpathogenic organisms proliferate in the water distribution network, whereas they were absent from the treated water at the outlet of the plant. To avoid this bacterial growth, (caused by rapid decomposition of ozone in water) a more stable oxidizing agent, such as chlorine or chlorine dioxide, is added continuously. The dose of chlorine or chlorine dioxide that must be added in the presence of ozone for maintaining water disinfection in the distribution network is affected by: (1) the level of each specific oxidizing agent present; (2) specific reactions of ozone with chlorine or chlorine dioxide; and (3) the effects of the two combined oxidants. This interference is further described. (See also W88-02503) (Lantz-PTT)
W88-02509

ANALYTICAL INSTRUMENTATION FOR CONTROL OF OZONATION SYSTEMS,
Societe Degremont, Rueil-Malmaison (France).
M. Pare.
IN: Handbook of Ozone Technology and Applications. Volume 1. Ann Arbor Science, Ann Arbor, MI. 1982. p 285-303, 11 fig, 1 tab, 5 ref.

Descriptors: *Chemical analysis, *Ozonation, *Monitoring, *Water quality, *Measuring instruments, Ozone, Chemiluminescence, Ultraviolet radiation, Amperometry, Calorimetry, Potentiometry.

Ozone is used increasingly in industry, particularly in water treatment, for its high oxidizing and bactericidal powers. Commercial production of ozone is obtained in reactors, known as ozonators, using the corona discharge process whereby air or oxygen is passed through a strong electric field. Ozone utilization consists of placing the ozonated gas into contact with the product to be treated. In the case of water treatment, for instance, a specific treatment parameter is the amount of residual ozone measured in the liquid after a certain contact time. Any leaks occurring during ozone production or application processes may be hazardous to operating personnel and surrounding equipment. Three types of instruments are available to measure: (1) atmospheric ozone or ozone present in the ambient air; (2) commercially produced ozone; and (3) ozone in liquids, particularly in water. These measurements are obtained via: (1) UV radiation; (2) chemiluminescence of ethylene; (3) amperometry; (4) calorimetry; and (5) potentiometry. Sixteen different instruments for obtaining these measurements are presented. (See also W88-02503) (Lantz-PTT)
W88-02510

DESIGN ENGINEERING ASPECTS OF OZONATION SYSTEMS,
Purdue Univ., Lafayette, IN.
For primary bibliographic entry see Field 5D.
W88-02511

MECHANISMS, RATES AND SELECTIVITIES OF OXIDATIONS OF ORGANIC COMPOUNDS INITIATED BY OZONATION OF WATER,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 5D.
W88-02512

DECONTAMINATION OF NITRATE POLLUTED WATER,
Minnesota Univ., Minneapolis. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5D.
W88-02693

CONCENTRATION OF SYNFUEL PROCESS CONDENSATES BY REVERSE OSMOSIS,
Bend Research, Inc., OR.
For primary bibliographic entry see Field 5D.
W88-02694

CONCENTRATION POLARIZATION EFFECTS IN THE USE OF MICELLAR-ENHANCED ULTRAFILTRATION TO REMOVE DISSOLVED ORGANIC POLLUTANTS FROM WASTEWATER,
Oklahoma Univ., Norman. School of Chemical Engineering and Materials Science.
For primary bibliographic entry see Field 5D.
W88-02695

SENSITIVE METHODS FOR THE DETERMINATION OF MICROBIAL ACTIVITIES IN WATER SAMPLES USING FLUORIGENIC SUBSTRATES,
ESWE-Inst. fuer Wasserforschung und Wassertechnologie G.m.b.H., Weisbaden (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W88-02723

APPROPRIATE METHODS OF TREATING WATER AND WASTEWATER IN DEVELOPING COUNTRIES.
For primary bibliographic entry see Field 5D.
W88-02732

PROBLEM, INTERFACE FOR DECISION AND APPROPRIATE TECHNOLOGY-SCIENCE TECHNOLOGY, TECHNOLOGY TRANSFER AND UTILIZATION,
Oklahoma Univ., Norman. School of Civil Engineering and Environmental Science.
For primary bibliographic entry see Field 6A.
W88-02733

PREDICTION METHODOLOGY FOR SUITABLE WATER AND WASTEWATER PROCESSES,
Oklahoma Univ., Norman.
For primary bibliographic entry see Field 5D.
W88-02734

WATER SUPPLIES IN RURAL AREAS OF DEVELOPING COUNTRIES,
Technische Hogeschool Delft (Netherlands).
For primary bibliographic entry see Field 6D.
W88-02736

METHODS OF CHOICE: SMALL WELLS, SLOW SAND FILTRATION, AND RAPID SAND FILTRATION FOR WATER SUPPLIES IN DEVELOPING AREAS,
National Taiwan Univ., Taipei.
K. G. Li.
IN: Appropriate Methods of Treating Water and Wastewater in Developing Countries. Ann Arbor Science, Ann Arbor, MI. 1982. p 186-206, 9 fig, 37 ref.

Descriptors: *Water treatment, *Sand filters, *Filtration, *Wells, *Developing countries, Groundwater mining, Infiltration, Disinfection, Coagulation, Coagulants, Flocculation, Sedimentation, Chlorination, Water treatment facilities.

Small wells and filtration methods for use in rural community water supplies in developing countries are described. To determine the appropriate location for a well, all the geological data available should be examined. Dug wells are holes or pits dug by hand or machine tools which extend into the ground to tap the water table. When dug wells are used to supply water to a small community it may be five or six meters in diameter and from three to twelve meters in depth. Bored wells are constructed by drilling in unconsolidated material with hand-operated or power-driven earth augers. Driven wells which are up to ten centimeters in diameter and twenty meters deep can be installed only in soft formations relatively free of cobbles or boulders. Jetted wells are constructed by a high-velocity stream of water which is directed downward into the earth to jet the well pipe into place. Sanitary protection of small wells includes the lining of the well sides with impervious material, applying an impervious apron around the well mouth, and assuring that an area within a radius of about fifteen meters from the well is kept free from pollution. Slow sand filtration is probably the cheapest and simplest method of water treatment. The advantages, mechanisms, and design of slow sand filters are discussed. Rapid sand filtration is readily adapted to more turbid waters. Rapid sand filtration plant processes of coagulation, flocculation, and sedimentation are discussed. Chlorination is used at rapid sand filter plants for destroying disease bacteria. Possible procedures for the disposal of water treatment plant residue include: direct discharge to a receiving stream with an adequate flow rate or drainage system, lagoons or sludge drying beds, hauling away for surface land application, discharge into a municipal sewerage system, recirculation and reuse of filter washwaters, dewatering of sludge, and reclamation of alum or other useful constituents. (See also W88-02732) (Geiger-PTT)
W88-02737

MODEL ACCEPTANCE, LESSONS OF HISTORY AND MANAGEMENT CONCERNS,
Oklahoma Univ., Norman.
For primary bibliographic entry see Field 6A.
W88-02740

MODIFIED LINEAR PROGRAMMING GRADIENT METHOD FOR OPTIMAL DESIGN OF LOOPED WATER DISTRIBUTION NETWORKS,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Industrial Engineering and Management.
O. Fujiwara, B. Jenchaimahakoon, and N. C. P. Edirisinghe.
Water Resources Research WRERAQ, Vol. 23, No. 6, p 977-982, June 1987. 1 fig, 3 tab, 17 ref.

Descriptors: *Network design, *Water distribution, *Linear programming gradient method, *Systems analysis, *Model studies, *Linear programming, *Computers, *Computer programs, *Data interpretation, Mathematical studies, Mathematical equations, Looped water distribution networks, Comparison studies.

A modified linear programming gradient (LPG) method is presented for solving looped water distribution network problems, together with a mathematically rigorous derivation of the LPG model. The LPG method of Alperovits and Shamir is modified in terms of both search direction and step size. A quasi-Newton search direction is proposed instead of the steepest descent direction, and the step size is determined by a backtracking line search method instead of a fixed step size. The modified method is applied to a numerical example, where it provides an improved solution in comparison to the original LPG method. (Author's abstract)
W88-02775

LEGIONELLA AND THE ENVIRONMENT,
Pittsburgh Univ., PA. Dept. of Industrial Environmental Health Sciences.
G. Keleti, and M. A. Shapiro.
CRC Critical Reviews in Environmental Control Vol. 17, No. 2, p 133-185, 1987. 6 tab, 120 ref.

Descriptors: *Legionella bacteria, *Bacteria, *Water supply systems, *Water treatment, *Public health, *Literature review, *Disinfection, *Human diseases, *Reviews, Hazards, Epidemiology, Cooling towers, Condensers, Institutions, Decontamination, Thermal alteration, Hyperchlorination, Pathology, Infection.

A review of the outbreaks of Legionnaire's Disease caused by a bacterium called Legionella pneumophila was presented and linked epidemiologically to aquatic environments including cooling towers and evaporative condensers attached to buildings, hotels, hospitals, shopping malls and other facilities. Because Legionella is commonly present in water supplies of health institutions, a reliable decontamination method is required which would decrease the number of Legionella so that the bacteria could be eliminated as the source of nosocomial infections among patients. The review article reported on recent information related to biological properties of Legionella spp. and analyzed the literature devoted to environmental sources, distribution, and amplification of Legionellaceae. The role of microorganisms in survival and multiplication of Legionella was described. Legionella antibacterial and decontamination methods, both proposed and previously used, including thermal alteration, hyperchlorination, disinfection with quaternary ammonium compounds, ozonation, and ultraviolet irradiation were evaluated critically. It was concluded that prevention of nosocomial infections of legionellosis can be realized almost fully in hospitals and institutions by use of thermal alteration procedures, hyperchlorination and proper maintenance of the water distribution system. The prevention of community-acquired legionellosis and outbreaks of the disease is more difficult and hinges on the establishment of the optimal concentration of effective disinfectants in different types of cooling systems. (Wood-PTT)
W88-02798

WATER TREATMENT IN THE KANSAS CITY METROPOLITAN AREA,
W. Anderson, R. Goold, and F. Pogge.
Water Engineering and Management WENMD2, Vol. 134, No. 5, p 32-36, May 1987.

Descriptors: *Water treatment facilities, *Water treatment, *Water distribution, *Water districts, *Kansas City, *Missouri, Kansas, Economic aspects, Water use, Wells, Water conveyance, Water management.

The Kansas City Metropolitan Area's population of nearly 1.2 million is distributed throughout seven counties in Kansas and Missouri. Among the major water utilities serving the needs of the metropolitan area are the City of Kansas City in Missouri, the City of Independence in Missouri, and the Water District No. 1 of Johnson County in Kansas. Profiles of each of these utility companies are presented showing differences in size, facilities, history and operating characteristics. Water treatment and conveyance methods are presented along with economic aspects for each utility company. (Wood-PTT)
W88-02806

UNCONVENTIONAL TOUCHES TO CONVENTIONAL DESIGN,
Stamford Water Co., CT.
G. Thornhill.
Water Engineering and Management WENMD2, Vol. 134, No. 5, p 48-49,54, May 1987.

Descriptors: *Water treatment facilities, *Water treatment, *Jet mixing, *Dynamic backwash, Mixing, Backwash, Economic aspects, Design criteria, Costs, Construction costs, Operating costs, Effluents.

Due to limited financial resources, Stamford Water Company managers and design engineers sought ways in which to minimize construction costs and future operating expenses of the new water treatment plant needed in order to comply with provisions of the Safe Drinking Water Act of 1974. The fiscal restrictions resulted in a seven-year construction project which provided the utility company with sufficient time to study a variety of design options, including jet mixing techniques and an adaptation of an automatic backwash system, and to consider the alternatives in terms of available, less-costly technology. Although a conventional design approach was selected, jet mixing techniques instead of the usual mechanical mixing technology was considered and adopted because of immediate savings in construction costs due to the lower interior space requirements of the jet mixer. Substantial operational savings because of decreased chemical usage, mixing time, and power consumption are also expected. Although jet mixing had been used previously in the treatment of wastewater, there were no known applications in the water-supply industry. There was, however, no risk involved in adapting the automatic backwash system to form a closed loop to return the backwash effluent to the original point of water entry into the plant using existing pumping capacity and eliminating the need for increasing the capacity of the clear well to provide the water supply required for a conventional backwash operation. The water treatment facility was put into service late in 1986 and the performance records of the jet mixer and the dynamic backwash system have met expectations so far in every major respect. (Wood-PTT)
W88-02807

WATER PLANT DESIGNED FOR MULTIPLE SOURCES,
Ossining Public Works Dept., NY.
M. R. Sterlacci, and W. E. McFarland.
Public Works PUWOAH, Vol. 118, No. 6, p 79-80, June 1987.

Descriptors: *Water treatment, *Water treatment facilities, *Multiple source water treatment, Ossining, New York, Drinking water, Combined water, Surface water, Water conveyance structures, Filtration, Raw water, Water quality control.

Faced with increasing demands for water and deteriorating raw water quality, the Village of Ossining, on the Hudson River in New York, undertook to expand and double the capacity of its surface water treatment plant. Special features of the new

facility include the ability to draw raw water from either of two sources or to blend water from both depending on the raw water quality, and the addition of a full-scale pilot filtration facility for experimentation with alternative filtration methods in order to determine the most effective and economical means of treatment. Details of the rehabilitation, expansion and adaptation of the existing water treatment plant to enable use of water from either the Indian Brook Reservoir or the Croton aqueduct or both were provided. (Wood-PTT)
W88-02811

ADJUSTING TO NEEDS AND NEIGHBORS IN WATER TREATMENT PLANT DESIGN,
Grand Haven City Manager, MI.
L. R. Deetjen, and R. C. Mulder.
Public Works PUWOAH, Vol. 118, No. 6, p 91-93, June 1987.

Descriptors: *Water treatment facilities, *Water treatment, *Economic aspects, *Water demand, Water management, Water rates, Water requirements, Water supply, Filtration, Water quality, Grand Haven, Michigan, Bond issues, Costs, Construction costs, Interest rates, Backwash, Public relations, Public opinion.

The plans for a new water treatment plant in Grand Haven, Michigan, were almost completed when high interest rates and the loss of several large water customers and increased residential water conservation changed the economic aspects of the project and the water demand. As a result of these events, the communities involved reassessed their previous water use projections and sought alternatives. An engineering study showed that a 12-mgd plant instead of the proposed 18-mgd facility would be adequate, that the old intakes could be used, and that if the existing site were used, the total cost of the new facilities would be about 6.9 million dollars rather than the previously proposed 15 million dollars. The treatment and backwash water reclamation systems for the revised project were described. Because the plant is located in a residential neighborhood, an extensive public information program was established and architectural and landscaping design received a great deal of consideration. Most treatment processes were constructed underground, which resulted in a relatively low silhouette for the building whose exterior walls were of materials compatible with the surrounding neighborhood. Economic aspects of the project funding were briefly discussed. (Wood-PTT)
W88-02813

LOW TECHNOLOGY WATER PURIFICATION BY BENTONITE CLAY AND MORINGA OLEIFERA SEED FLOCCULATION AS PERFORMED IN SUDANESE VILLAGES: EFFECTS ON SCHISTOSOMA MANSONI CERCARIAE,
Danish Bilharziasis Lab., Charlottenlund.
A. Olsen.
Water Research WATRAG, Vol. 21, No. 5, p 517-522, 1987. 5 fig, 1 tab, 21 ref.

Descriptors: *Bentonite, *Water treatment, *Parasites, *Flocculation, Turbidity, Drinking water, Sudan, Nile River.

Schistosoma mansoni cercariae were removed from clear and turbid water by flocculation with Sudanese bentonite clays, with Moringa oleifera seeds as well as with pure bentonite. The flocculation technique employed corresponds to that used to clarify Nile water in Sudanese villages. Moringa seeds, pure bentonite and one type of bentonite clay were able to reduce the number of cercariae by more than 90%, indicating that in addition to their clarifying properties, these materials have a hygienic effect. (Author's abstract)
W88-02821

AGEING OF ALUMINIUM HYDROXIDE FLOCS,
British Aerospace Aircraft Group, Kingston upon Thames (England).
R. J. Francois.
Water Research WATRAG, Vol. 21, No. 5, p 523-531, 1987. 17 fig, 3 tab, 24 ref.

Descriptors: *Flocculation, *Water treatment, *Aluminum sulfate, *Aging, Kaolinite, Mathematical analysis, Electrophoresis, Solubility, Aluminum.

The aging processes of kaolinite suspensions flocculated with Al2(SO4)3 under a variety of different but well-controlled flocculation conditions were studied by measuring their average diameter, diameter distribution, strength, and electrophoretic mobility. Three periods could be distinguished in the aging process. Initial floc shrinkage is due mainly to cementation-aggregation. In the first 6-8 h, dependent on conditions, average diameter reduces from about 500 to about 220 micrometers. During the following 4 days a shrinkage to about 180 micrometers occurs, due mainly to condensation-polymerization and crystallization. In the third period, average diameter increases because of Oswald ripening of the crystals. During aging, floc diameter distribution narrows. Floc shrinkage during aging is definitely not due to erosion of particles from the floc surface. The change in electrophoretic mobility during aging provides information on the thickness and homogeneity of the layer of insoluble hydroxides around the destabilized clay particles. The influence of a wide range of different flocculation process parameters on the floc aging process is summarized, as is the influence of the aging process on floc strength and floc density. The evolution of the effective floc density can be described mathematically (a formula is given in the text). (Airone-PTT)
W88-02822

EFFECT OF OXIDANTS ON MICROALGAL FLOCCULATION,
Technion - Israel Inst. of Tech., Haifa. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 5D.
W88-02823

CORRELATION OF HUMIC SUBSTANCE TRIHALOMETHANE FORMATION POTENTIAL AND ADSORPTION BEHAVIOR TO MOLECULAR WEIGHT DISTRIBUTION IN RAW AND CHEMICALLY TREATED WATERS,
King Saud Univ., Riyadh (Saudi Arabia). Dept. of Civil Engineering.
A. M. El-Rehaili, and W. J. Weber.
Water Research WATRAG, Vol. 21, No. 5, p 573-582, 1987. 14 fig, 5 tab, 13 Research Grant No. 80735901 from Exploratory Research Programs, U. S. EPA.

Descriptors: *Humic acids, *Adsorption, *Chloroform, *Chlorination, *Water treatment, Chemical reactions, Organic compounds, Activated carbon, Liming, Aluminum sulfate, Fulvic acids, Chlorinated hydrocarbons, Carcinogens.

The molecular weight distributions (MWDs) of several commercially prepared humic and fulvic acids and organic matter present in natural waters were analyzed by gel chromatography. The responses of these substances to treatment by alum coagulation, lime softening, and activated carbon adsorption were also analyzed, as were their trihalomethane formation potentials before and after each treatment. The treatability characteristics and trihalomethane formation potentials of the different organic substances were then related to their respective MWDs. Differences in the MWDs were found to effect differences in the behavior of lumped parameter measures of organic matter (such as TOC) with respect to the several treatment operations. The treatments in turn were observed to alter the MWDs of the organic substances as well as their phenomenological behavior in subsequent process operations. (Author's abstract)
W88-02828

OZONE ABSORPTION IN WATER: MASS TRANSFER AND SOLUBILITY,
Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Anlyse des Interactions et Couplages.
For primary bibliographic entry see Field 5D.
W88-02851

RATIONALES FOR MULTIPLE STAGE OZONATION IN DRINKING WATER TREATMENT PLANTS,
Rice International Consulting Enterprises, Aston, MD.
R. G. Rice.
Ozone Science and Engineering OZSEDS, Vol. 9, No. 1, p 37-62, 1987. 8 fig, 8 tab, 20 ref.

Descriptors: *Ozonation, *Water treatment, *Disinfection, *Drinking water, Costs, Energy, Tastes, Odors, Case studies.

Starting in the early 1970s, the application of ozone for drinking water treatment began to evolve from primarily single-purpose, single-stage use for disinfection, taste and odor control or iron and manganese oxidation, to multi-purpose uses of ozone. As a result, most of the newer drinking water treatment plants have installed two- and even three-stages of ozonation, in order to maximize the technological benefits of ozone and to minimize the costs involved. Several case examples of two- and three-stage ozonation are discussed. In many instances the application of several stages of ozone actually requires less ozone (therefore less energy) than when applied for disinfection alone in a single-stage. In addition, higher water qualities are obtained by applying these new ozonation principles. (Author's abstract)
W88-02852

BACTERIAL COLONIZATION AND ENDOTOXIN CONTENT OF A NEW RENAL DIALYSIS WATER SYSTEM COMPOSED OF ACRYLONITRILE BUTADIENE STYRENE,
Harvard School of Public Health, Boston, MA.
For primary bibliographic entry see Field 5B.
W88-02870

OXIDATION OF TRACE CONTAMINANTS IN DRINKING WATER,
Louisiana State Univ., Baton Rouge. Dept. of Chemical Engineering.
F. Groves.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-170461/AS. Price codes: A02 in paper copy, A01 in microfiche. Completion Report, Louisiana Water Resources Research Institute, Baton Rouge. December 1985. 14 p, 4 tab, 13 ref. Contract No. 14-08-0001-G-909. Project No. USGS G909-02.

Descriptors: *Drinking water, *Chlorinated hydrocarbons, *Louisiana, *Water treatment, Oxidation, Potassium ferrate.

Contamination of drinking water by traces of organic chemicals is of special concern because of health effects of these materials. Louisiana waters are especially susceptible to this contamination because of industrial discharges stemming from large petrochemical industries. Chlorinated organics in drinking water can arise from industrial effluents or from chlorination of naturally occurring organics during disinfection. The objective of this project was to study the use of a powerful oxidizing agent, potassium ferrate, for the decomposition of organics in drinking water. Benzene, dichloroethane, trichloroethylene, chloroform, chlorobenzene, and tetrachloroethylene at 100 ppb in water were treated at room temperature with ferrate. Fifty to one hundred parts of ferrate by weight were used per part of organic. The pH was in the 6.5-7.5 range. Only trichloroethylene was much affected by ferrate. It was 41 to 87% decomposed. The other organics were less than 25% decomposed. It is concluded that potassium ferrate is unlikely to be generally useful in oxidizing chlorinated organics in water. (Groves-LA St. U.)
W88-03178

DESTRUCTION OF HAZARDOUS COMPOUNDS BY ULTRAVIOLET CATALYZED OXIDATION WITH HYDROGEN PEROXIDE,
Connecticut Univ., Storrs.
D. W. Sundstrom, and H. E. Klei.
Available from the National Technical Information Service, Springfield, VA 22161, as PB87-149357/AS. Price codes: A04 in paper copy, A01 in microfiche. Final Technical Completion Report. October 1986. 71 p, 45 fig, 3 tab, 28 ref. Contract No. 14-08-0001-G-1064. Project No. USGS G1064.

Descriptors: *Hazardous materials, *Hydrogen peroxide, *Ultraviolet radiation, *Water treatment, Aromatic compounds, Chlorinated hydrocarbons, Oxidation.

Toxic and hazardous compounds are often present in water supplies at low concentrations, which can make their removal difficult and costly by conventional treatment processes. This project investigated the destruction of hazardous compounds in water by ultraviolet catalyzed oxidation using hydrogen peroxide as the oxidizing agent. The effectiveness of this process was determined with a variety of aliphatic and aromatic compounds, including trichloroethylene, chloroform, dichloromethane, benzene, chlorobenzene, chlorophenol, and diethyl phthalate. The reactions were conducted in batch and flow reactors equipped with low pressure ultraviolet lamps. The course of the reactions was followed with time by analysis of samples with a flame ionization gas chromatograph. The combination of ultraviolet light and hydrogen peroxide was effective in decomposing all of the organic compounds studied. The rates of destruction increased with increasing hydrogen peroxide concentration and ultraviolet light intensity, and were highly dependent on chemical structure. Trichloroethylene and 2,4,6-trichlorophenol had the fastest reaction rates among the compounds studied. The concentrations of these compounds could be reduced to 1% of the original values in less than 50 min reaction time. For the chlorinated aliphatics, all of the reacted chlorine was converted to chloride ion, indicating that the chlorinated structures were destroyed. (USGS)
W88-03186

CONTRIBUTION OF TAP WATER TO MINERAL INTAKES OF CANADIAN PRESCHOOL CHILDREN,
Guelph Univ. (Ontario). Dept. of Nutrition.
For primary bibliographic entry see Field 5C.
W88-03478

5G. Water Quality Control

ANALYTICAL INSTRUMENTATION FOR CONTROL OF OZONATION SYSTEMS,
Societe Degremont, Rueil-Malmaison (France).
For primary bibliographic entry see Field 5F.
W88-02510

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUBSTANCES.
For primary bibliographic entry see Field 5C.
W88-02513

STUDY ON IMPROVEMENT OF THE MARINE ENVIRONMENT,
Bureau of Ports and Harbors, Tokyo (Japan).
K. Fujimori.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 1-14, 9 fig, 3 tab.

Descriptors: *Water quality control, *Marine environment, *Water pollution control, Eutrophication, Organic loading, Seawater, Cleanup operations.

Although the marine environment in Japan has significantly improved, problems such as eutrophication in closed bays still remain. The Ministry of Transport has undertaken an investigation with regard to improving the marine environment through direct control projects (undertaken by the Ministry of Transport) and subsidized projects (undertaken by local public bodies with government subsidy). Special investigations are made on the prevention and elimination of organic pollution in closed bays. This paper describes future studies on improvement of the marine environment with special reference to changes in the marine environment and results obtained in investigations already conducted. Change in seawater, and bottom sludge, sea circulation, the self-cleaning of the sea and its enhancement, and future sea cleaning measures are aspects of this discussion. (See also W88-02513) (Lantz-PTT)
W88-02514

LAKE RESTORATION METHODS: SOME WORK, SOME DON'T,
Corvallis Environmental Research Lab., OR.
S. A. Peterson.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 15-25, 37 ref.

Descriptors: *Lake restoration, *Water quality, *Cleanup operations, Biomass, Biological treatment, Water circulation, Hypolimnetic withdrawal, Withdrawal, Sediment load, Nutrients, Performance evaluation.

Lake restoration has grown out of pilot and full-scale lake manipulation studies of the late 1960s and early 1970s. Some procedures have proven to be successful, and some have failed. This paper broadly divides the techniques into those that have proven to be successful, those that require more research, and combinations of treatments that are desirable together and those that should be avoided together. The procedures are divided further into those that reduce nutrient concentrations, and those that control algae and macrophyte biomasses directly. At present, solutions seem to be based almost exclusively on the application of chemicals or the introduction of machinery. In many cases these approaches are effective, but they are also expensive. The developing interest in biological control may greatly add to the arsenal of effective and inexpensive techniques. This avenue may become extremely important in the near future as the demand for clean water increases. Nutrient diversion, dilution/flushing, sediment removal, drawdown, sediment covers, hypolimnetic withdrawal, and artificial circulation are just some of the techniques presented. (See also W88-02513) (Lantz-PTT)
W88-02515

TEST RESULTS OF SEDIMENT REMOVAL IN ISE BAY,
Port Construction Bureau, Nagayo (Japan). 5th District.
T. Nakano, M. Natori, and Y. Taguchi.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 85-102, 14 fig, 1 tab, append.

Descriptors: *Water quality control, *Sediment removal, *Ise Bay, *Japan, *Dredging, Environmental effects, Nutrients, Organic matter, Decomposition, Benthos, Sediments.

Studies were conducted to obtain a feasible method for sediment removal in Ise Bay. These studies were conducted in Mikawa Bay, Japan to ascertain the effect and method of sediment removal since 1980. These studies were conducted prior to carrying out the sediment removal in Ise Bay, one of the major works for improvement of the ocean environment. The effects of sediment removal were studied, in terms of the amount of released organics and nutrients, and recovery of biotas and other findings in dredging tests performed in 1980 in highly contaminated sediments. Conclusions year after the test was completed are as follows: (1) The organic and nutrient content in sediment was reduced; (2) The pore water index was low in the dredged inside area; (3) Decomposition rate of organics in sediment tended to be higher in the outside area; and (4) For benthos, the numbers of individuals, number of species, and wet weight increased considerably inside the area as compared with the outside area. However, the results of a longer term study show that the difference between the outside area and the dredged inside area is diminishing, and can be considered ineffective for long-term removal effects. This results from redeposition of sediment from surroundings areas. From the test and follow-up study, it was determined that the dredging would be effective for 1 year; therefore, sediment removal would be considered as one of the major methods for ocean environmental improvment. (See also W88-02513) (Lantz-PTT)
W88-02519

EVALUATION OF DREDGING AS A REMEDIAL TECHNOLOGY FOR THE COMMENCEMENT BAY SUPERFUND SITE,
Corps of Engineers, Seattle, WA. Seattle District.
K. E. Phillips, and J. F. Malek.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 103-135, 4 fig, 14 tab, 10 ref.

Descriptors: *Dredging, *Cleanup operations, *Commencement Bay, *Washington, *Superfund sites, Waste disposal, Disposal sites, Contaminated sediments, Puget Sound, Performance evaluation.

Recent studies in Puget Sound, Washington have demonstrated a link between elevated concentrations of chemicals in bottom sediments and serious diseases (e.g., liver carcinomas) in bottom-dwelling fish. These and other studies have led to intensified efforts to identify contaminant sources and to clean up problem sediments. Remedial action at the Commencement Bay Nearshore/ Tideflats Superfund Site is expected to include dredging and disposal of contaminated sediments from the bay's industrialized waterways. In addition, intensive navigation activities often require handling contaminated sediments. In response to this close interaction between Superfund cleanup investigations and navigation needs, the Corps of Engineers assisted the State of Washington by conducting an analysis of alternative dredging methods and equipment, disposal methods and sites, and site control and treatment practices for contaminated sediments derived from the bay. This paper reviews some of the conclusions of the alternatives study regarding preferred dredging and disposal practices for sediment contamination found in Commencement Bay. Factors influencing contaminant mobility and an example application of chemical partitioning coefficients to a screening assessment of contaminated sediments are discussed. Key considerations in selecting appropriate equipment and methods, and the preferred methods for various classes of contaminants, are presented. Subsequent work by the Corps to develop decisionmaking guidance for dredged material management is briefly reviewed. The Commencement Bay Superfund evaluations served to highlight a number of issues related to navigation project planning, acceptable disposal practices, and long-term management of contaminated sediments. The influence and consequences of these issues to dredged material management in Puget Sound are discussed. (See also W88-02513) (Author's abstract)
W88-02520

DEVELOPMENT OF LEACHATE TESTING PROTOCOLS FOR DISPOSAL OF CONTAMINATED SEDIMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 5B.
W88-02522

METHOD FOR ESTIMATION OF METHYLMERCURY DISSOLVED INTO WATER FROM DREDGED MATERIAL BY USING THE MARINE COPEPOD ACARTIA CLAUSI,
Kumamoto Univ. (Japan).
For primary bibliographic entry see Field 5A.
W88-02523

WATER QUALITY MANIPULATIONS IN A EUTROPHIC IMPOUNDMENT,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
J. W. Barko, A. R. Klemer, D. G. McFarland, and R. L. Chen.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./ Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 164-175, 3 fig, 3 tab, 21 ref.

Descriptors: *Water quality control, *Eutrophic waters, *Reservoirs, *Eau Galle Reservoir, *Wisconsin, Phytoplankton, Algae, Phosphorus, Silica, Aluminum sulfate, Nutrients, Species composition.

Poor water quality in Eau Galle reservoir, located in west-central Wisconsin, has been associated historically with an overabundance of nuisance planktonic algae (phytoplankton) during the summer months. In an attempt to improve water quality, a variety of experiments was conducted over a 2-year period in large (10 m diameter) enclosed water columns. Specific objectives of these experiments were to reduce phytoplankton standing crop and to promote favorable changes in species composition, i.e., away from nuisance algae (cyanophytes and dinoflagellates) toward more desirable algae (diatoms and chlorophytes). Experimental treatments, implemented singly and in combination, included destratification by mixing, addition of soluble silica, sediment sealing with sand, and precipitation of phosphorus with block aluminum sulfate. Mixing, alone or in combination with silica addition, extended the presence of vernal diatom populations into the summer in one investigation. In general, mixing stimulated phytoplankton production by increasing phosphorus availability. However, phosphorus inactivation with block aluminum sulfate suspended in the water was sufficient to overcome this effect. Individual effects of phosphorus precipitation and sediment sealing were similar; both decreased phytoplankton standing crop in association with decreased total phosphorus concentrations. Since most of the phosphorus contributed to the phytoplankton in Eau Galle reservoir derives from the sediment, complexation of sediment phosphorus is recommended to improve water quality. (See also W88-02513) (Author's abstract)
W88-02524

TECHNIQUES FOR MONITORING STABILITY OF OFFSHORE SUBMERGED DISPOSAL MOUNDS,
Coastal Engineering Research Center, Vicksburg, MS.
For primary bibliographic entry see Field 7A.
W88-02531

USE OF ANTI-TURBIDITY CURTAINS AT A SAND COMPACTION PILING AREA IN YOKOHAMA HARBOUR,
Japan Bottom Sediment Management Association, Tokyo.
R. Hatano, and Y. Abe.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./ Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 264-279, 21 fig.

Descriptors: *Yokohama Harbor, *Anti-turbidity curtains, *Sand, *Water pollution control, *Sedimentation, Suspended sediments, Compaction, Japan, Suspended solids.

Sea work, such as dredging and sand compaction piling, causes turbidity in the surrounding sea area. To prevent diffusion of turbidity, anti-turbidity curtains are generally used in the working area. There are two kinds of anti-turbidity curtains, continuous and jointed. The continuous type requires a large space for assembly on land and much work to place it at sea. Compared with the continuous type, the jointed type requires a minimum of space for assembling and erecting. The jointed type can also be placed at sea by connecting the elements. In such cases it is important to know how the curtains affect suspended solids in seawater. In 1984, anti-turbidity curtains were used at a sand compaction work area in Yokohama Harbor, and the behavior of suspended solids around the curtains was observed. This paper reports the data measured at that time. (See also W88-02513) (Lantz-PTT)
W88-02532

GROUND WATER QUALITY.
John Wiley and Sons, New York, NY. 1985. 547 p. Edited by C. H. Ward, W. Giger, and P. L. McCarty.

Descriptors: *Groundwater quality, *Research priorities, *Water quality control, *Groundwater pollution, Water pollution sources, Water pollution control, Water pollution prevention, Information exchange.

The First International Conference on Ground Water Quality Research sponsored by the National Center for Ground Water Research stressed the chemical and biological aspects of groundwater and was intended to: (1) focus attention on the scientific and technological challenges and accomplishments in groundwater quality research, (2) provide a forum for assessing the state-of-the-art of knowledge in this area on an international scale, and (3) result in a major technical reference on groundwater quality. The Conference was held October 7-10, 1981 on the campus of Rice University in Houston, Texas. The Directors of the Conference and editors of this volume organized the program into four symposia dealing with (1) sources, types, and quantities of contaminants in groundwater, (2) methods for groundwater quality research, (3) subsurface characterization in relation to groundwater pollution, and (4) transport and fate of subsurface contaminants. This volume is not a proceedings of the First International Conference on Ground Water Quality Research. Rather, it brings together chapters in four subject areas which together contribute significantly to the understanding of groundwater quality. (See W88-02534 thru W88-02558) (Lantz-PTT)
W88-02533

CALMING THE RESTLESS NATIVE: HOW GROUND WATER QUALITY WILL ULTIMATELY ANSWER THE QUESTIONS OF GROUND WATER POLLUTION,
National Water Well Association, Worthington, OH.
J. H. Lehr.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 11-24, 8 fig.

Descriptors: *Groundwater pollution, *Groundwater quality, *Water quality control, Water supply, Costs, Groundwater depletion.

It has been written that less than 1% of the nation's groundwater supply is polluted. This figure has been used by numerous independent hydrogeologists, and even officials of the U.S. Geological Survey, and this paper attempts to prove that this is absolutely right. However, we have yet to pollute 1% of our total water supply. The initiation of new sources of pollution can be eliminated within 10 years, and a public ethic and morality which will put an end to all such ill-conceived practice can be created. The existing plumes will not have moved much further or polluted much more. The odds are in our favor to keep 98% of groundwater still unpolluted at the end of this century. It will frequently cost more to get because it may be necessary to drill at greater distances from the point of use and to greater depths, but that is still a small price to pay for such a precious resource. If the pollution of groundwater is stopped now, pollution can be stopped, keeping the polluted percentage low. Additionally some aquifers can be restored, water can be treated, and the movement of some hazardous plumes reduced, even though some sources of groundwater may have to be abandoned (See also W88-02533) (Lantz-PTT)
W88-02534

BIBLIOGRAPHY OF EFFECTS OF COMMERCIAL NAVIGATION TRAFFIC IN LARGE WATERWAYS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 6G.
W88-02560

SUPPLEMENTAL LIMNOLOGICAL STUDIES AT RICHARD B. RUSSELL AND CLARKS HILL LAKES, 1983-1985,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 2H.
W88-02561

WATER QUALITY MODELS USED BY THE CORPS OF ENGINEERS.
Army Engineer Waterways Experiment Station, Vicksburg, MS.
Information Exchange Bulletin No. E-87-1, March 1987. 3 p, 1 tab.

Descriptors: *Water quality, *Model studies, *Hydrologic models, Environmental effects, Water resources development, Environmental impact statement, Temperature, Dissolved oxygen, Reservoirs, Hydraulic models.

During and following the Environmental and Water Quality Operational Studies (EWQOS) Program, a variety of water quality models for inland surface waters were identified/developed to help evaluate the effects of Corps of Engineers (CE) water-resources activities. These models vary widely in their purposes, assumptions, and capabilities. There is no single model that is best suited for all applications, rather one should select the most appropriate model for a particular application. Model selection is the most important step of the model-application process. Selection should include consideration of such factors as model availability, study issues, characteristics of the system to be modeled, and time and budget constraints. The following table, which highlights the major features and capabilities of water quality models used by the CE, should help with the model-selection process. Although the table appears to contain a significant amount of information, it is actually quite abbreviated when compared with the total information available for each model. The user manuals and documentation should be reviewed to gain a better appreciation for model features. Potential users can also obtain additional information from the points-of-contact listed in the table. (See also W88-02563) (Author's abstract)
W88-02589

GROUNDWATER CONTAMINATION AND AQUIFER RECLAMATION AT THE ROCKY MOUNTAIN ARSENAL, COLORADO,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 5B.
W88-02608

GROUNDWATER RESTORATION WITH IN SITU URANIUM LEACH MINING,
Texas Univ. at Austin.
For primary bibliographic entry see Field 5G.
W88-02614

GROUNDWATER RESTORATION WITH IN SITU URANIUM LEACH MINING,
Texas Univ. at Austin.
R. J. Charbeneau.
Groundwater Contamination, National Academy Press, Washington, DC. February 1984. p 147-155, 2 fig, 1 tab, 14 ref.

Descriptors: *Groundwater pollution, *Leaching, *Uranium, *Path of pollutants, *Water pollution treatment, *Mine drainage, Groundwater management, Water pollution sources, Groundwater movement, Leachates, Mine wastes.

An overview of the in situ mining technology, including U deposition, mining techniques, and groundwater restoration alternatives is presented. When exploration indicates the existence of an ore body, a sampling, testing, and monitoring program is established to determine the extent and

quantity of ore, baseline water quality, and optimal well pattern design. Monitors wells are drilled to study the effects of mining activities on water quality. In situ U mining affects groundwater quality directly by the introduction of compounds with the leaching solution and indirectly by the release of materials such as heavy metals from dissolution of minerals present in the rocks. Groundwater restoration entails a range of techniques from in situ processes within the aquifer to surface-separation processes that treat the water at the surface for later reinjection to the former production zone or disposal by other means and finally to ultimate disposal methods that dispose of the water that is not feasible to treat. Associated with the in situ and surface-separation processes of restoration are the methods for removal of water from the aquifer - groundwater sweeping and groundwater recirculation. In a groundwater sweep, injection operations are curtailed and a number of wells are used as production wells, which draw water from the contaminated part of the aquifer (production zone) and draw cleaner water from the nonaffected part of the aquifer. Restoration by groundwater recirculation is achieved through the continued pumping through the same production and injection wells used in the mining oeprations, except that the direction of induced flow may change and the groundwater is reinjected without being reconstituted with the leaching solution. The development and economics of in situ mining in South Texas are discussed. Restoration activities in this area showed that groundwater sweeping may require larger volumes of water for effective U removal. Recirculation with retreatment of the waste stream before reinjection is preferred. (See also W88-02602) (Geiger-PTT)
W88-02614

HAZARDOUS WASTES IN THE UK - AN OVERVIEW,
Open Univ., Milton Keynes (England).
For primary bibliographic entry see Field 5E.
W88-02641

LEGAL CONTROL OF HAZARDOUS WASTE MANAGEMENT AND TRANSPORT IN THE UK,
Cleanaway Ltd., Rayleigh (England).
For primary bibliographic entry see Field 5E.
W88-02642

HYDROGEOLOGICAL ASSESSMENT AND SELECTION OF HAZARDOUS WASTE DISPOSAL SITES,
FGS Associates Ltd., Sipson (England).
For primary bibliographic entry see Field 5E.
W88-02643

LEACHATE PRODUCTION, CONTROL AND TREATMENT,
Cleanaway Ltd., Rayleigh (England).
For primary bibliographic entry see Field 5E.
W88-02644

WATER QUALITY ANALYTICAL TECHNIQUES,
Strathclyde Regional Council, Glasgow (Scotland).
D. Yeoman.
IN: Hazardous Waste Management Handbook, Butterworths, London, England. 1985. p 167-208, 9 fig, 2 tab, 57 ref.

Descriptors: *Analytical methods, *Monitoring, *Water quality control, *Chemical analysis, Hydrogen ion concentrtion, Turbidity, Color, Conductivity, Alkalinity, Acidity, Permanganate, Oxygen, Total organic carbon, Chemical oxygen demand, Ammonia, Nitrogen, Chlorides, Hardness, Phosphates, Fluorides, Sulfides.

When the analytical chemist considers the analyses which he will have to carry out to determine the quality of a water resource, he must take into consideration the relevant legislation laid down and the standards to be met. Now that the UK is a member of the EEC, all water quality is, or will be, governed by twelve water quality directives. Several of these have a particular bearing on possible pollution arising from hazardous waste leachate contaminating surface or underground water. The analytical techniques which are discussed here, can be of value in the analysis of surface or groundwater affected by landfill leachate and should help to determine the level and extent of any contaminant migration. The methods may be useful in the analysis of leachate, either treated or untreated, and also in the analysis of effluent from a hazardous watse reprocessing plant. This type of analysis is usually carried out to determine the suitability of the leachate or effluent for disposal to a watercourse. There are, however, two factors about leachate analysis which must be noted. The first is that it is possible for the composition of leachates to alter after sampling, even with storage at 5 C and the second is that, on occasions, some substances present can interfere with the precision of the standard analytical method used in water analysis. The techniques are divided into two types of determinations: non-specific and specific. Non-specific methods included: pH, turbidity, color, electrical conductivity, alkalinity and acidity, permanganate value, biochemical oxygen demand, total organic carbon, and chemical oxygen demand. Specific methods are: free ammonia, total oxidized nitrogen, chloride, total hardness, phosphate, fluoride, sulfide, cyanide, and ion selective electrodes. (See also W88-02640) (Lantz-PTT)
W88-02646

ACID RAIN SOURCEBOOK.
McGraw-Hill, Inc., New York, NY. 1984. 290 p. Edited by Thomas C. Elliott and Robert G. Schwieger.

Descriptors: *Acid rain, *Water pollution effects, *Legislation, *Water pollution sources, Conferences, Acidic water, Environmental effects, Water pollution control, Path of pollutants.

Last year, the editors of POWER magazine, recognizing an escalating, world-wide concern about acid rain, decided to provide a forum for the serious discussion of this emotionally charged issue. Out of this decision grew the First International Conference on Acid Rain, which was held in Washington, DC, on March 27-28, 1984. Because the conference delved into so many areas critical to the acid rain issue - problem definition, impact of legislation, emissions standards, international perspective, cost scenarios, engineering solutions - it was felt that the specialized information generated deserved a wider audience than the 200 or so who attended the meeting. Out of this decision 'The Acid Rain Sourcebook' was planned and published. The product of more than two dozen experts, the book is divided into seven key sections (Problem and the Legislative Solutions, Interntaional Mitigation Programs, Planning the US Program, Emissions Reduction - Before Combustion, Emissions Reductions - During Combustion, Emissions Reduction - After Combustion, and Engineering Solutions Under Development) and 20 chapters, plus an overview designed to introduce readers new to acid rain to a brief review of the problem, the legislation, and the technology. (See W88-02651 thru W88-02670) (Lantz-PTT)
W88-02650

CURRENT LEGISLATIVE DIRECTIONS,
Wald, Harkrader and Ross, Washington, DC.
C. C. Abeles.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 27-36, 8 ref.

Descriptors: *Legislation, *Acid rain, *Legal aspects, *Water pollution control, Federal jurisdiction, Sulfur dioxide.

Acid rain is the focus of a great deal of attention on Capitol Hill; there are approximately 20 bills on the subject in Congress at the present time. Described here are the two most important of those bills: S.768, 98th Contress, 1st Session (1983), and H.R.3400, 98th Congress, 1st Session (1983). Before doing so, however, it is useful to review the major questions that arise in the acid rain context so that we can see how the drafters of S768 and H.R.3400 have resolved these issues. Both bills provide for large-scale reductions in sulfur dioxide emissions. It is too early to say whether either bill (or bills like H.R.5314) is likely to be enacted into law. The debate over acid rain is going to remain intense, however, as these and other proposals move through the legislative process. (See also W88-02650) (Lantz-PTT)
W88-02652

IMPACT OF LEGISLATION ON ELECTRIC UTILITIES,
Tennessee Valley Authority, Chattanooga. Div. of Energy Demonstrations and Technology.
M. D. High, and H. W. Elder.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 37-44, 4 fig, 6 tab.

Descriptors: *Legislation, *Utilities, *Electric power, *Costs, *Acid rain, *Economic aspects, Water pollution control, Electric powerplants.

As scientists began to provide some answers to questions regarding environmental effects of acid rain, long-range transport of pollutants, and the chemistry of rainfall, the major debate shifted from the scientific to the political arena, where state and Federal legislators reacted to constituent pressure to 'do something' about acid rain. Today, there are some signs that the debate may be shifting back at least partially, to the scientific arena, but acid rain legislation remains a high-priority item in Congress and looms as a potential election year issue. From the utility industry's perspective, a central issue with regard to acid rain legislation is the potential costs to its ratepayers. The various legislative proposals currently pending hope to reduce the perceived environmental effects of acidic deposition by controlling powerplant emissions. A number of studies have been published recently by various segments of the utility industry, by independent firms, and by government agencies which attempt to define the costs of pending legislation to utilities and their ratepayers. A least-cost strategy for reducing emissions would save the nation up to about $800-million/yr if emissions reductions of 8-million tons or less from coal-fired powerplants are required. For emissions reductions greater than 8-million tons, the saving decreases. At about 11-million tons, the costs are the same. (See also W88-02650) (Lantz-PTT)
W88-02653

IMPACT OF 'MOST LIKELY' LEGISLATION ON INDUSTRY,
Kaiser Aluminum and Chemical Corp., Columbus, OH. Midwest Region.
R. W. Irelan.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 45-50.

Descriptors: *Legislation, *Industrial development, *Water pollution control, *Economic aspects, *Acid rain, Costs.

Today, the legislative activity on acid rain control is, to say the least, brisk and fluid. It is not easy to identify the 'most likely' legislation. All parties involved in acid deposition legislation have an absolute responsibility to know where they want and need to go, and are as certain as possible that the right course is followed. While hasty adoption of acid rain controls may be politically expedient, additional patient and thorough research should make possible policies that are environmentally sound and cost effective. The billions of dollars that would be called for by control legislation now being debated in Congress would necessarily lessen the amount of resources available for addressing other social priorities. And, many in industry are convinced that the price of premature, misdirected action would be paid in lost jobs, lost economic wealth, and lost industry. (See also W88-02650) (Lantz-PTT)
W88-02654

COST OF CONTROL - WHO WILL PAY,
Environmental Management Associates, Princeton, NJ.

G. C. Ford.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 51-54.

Descriptors: *Costs, *Water pollution control, *Acid rain, *Economic aspects, Electric powerplants, Industrial development, Sulfur.

The debate over acid rain has raised a number of issues which have to a considerable degree polarized the positions of the parties and groups which would be involved: the electric utilities and industry; the regions affected environmentally by acid rain; states contributing the greatest amount of acid-producing emission; and the regions producing high- and low-sulfur coal. It is obvious that the political forces representing the underlying interests in the acid rain issue are deeply divided and no consensus is near. Therefore, just speculation can be made on the outcome, until a program is enacted and fully defined. Perhaps, however, an examination of past precedents, political realities, and administrative practicalities will suggest an outine of a program which may emerge from the process: (1) The first phase may be more modest than an 8- to 10-million-ton/yr reduction and a 31-state area; (2) Tonnage-reduction targets would be turned over to the states to determine compliance action by individual utilities and thus could reflect local concerns for hardship situations; (3) A trust fund financed by a generation levy would be available to help finance capital expenditures such as scrubbers; and (4) The remaining costs will be paid for and borne as determined by the normal rate-making process. The result could be a good deal of freedom by utilities and industry to choose the most economical means of compliance, except for constraints on fuel switching that might be imposed in high-sulfur coal-producing states. The argument against the broad based generation levy by other regions which have already paid the cost of reduced SO2 emissions would be lost. (See also W88-02650) (Lantz-PTT)
W88-02655

CANADIAN ACID RAIN PROGRAM,
Ontario Ministry of the Environment, Rexdale.
J. W. Giles.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 56-63, 20 ref.

Descriptors: *Canada, *Acid rain, *Water pollution control, *Air pollution, *International agreements, Water pollution prevention, Federal jurisdiction, Provincial jurisdiction, Legislation.

Canada is a confederation and its constitution does not allocate exclusive jurisdiction over the environment to either the federal or provincial levels of government. As a result, the federal and provincial governments share jurisdiction over environmental matters. The provinces have primary responsibility for the control of intraprovincial air pollution while the Federal government has jurisdiction over extraprovincial air pollution. The sulfur dioxide program, early action and cooperation, and obstacles to overcome for progress in this arena, are discussed. The Federal government may negotiate and conclude treaties and other types of international agreements. However, this does not give the Federal government exclusive power to implement the terms of any such treaty or agreement. Such implementation is effected in accordance with the divisions of legislative power set out in the constitution. Consequently, the effective implementation of controls on airborne pollutants will require both federal and provincial action. This reality is evident in the close federal/provincial collaboration which has developed around all aspects of the acid rain issue. (See W88-02650) (Lantz-PTT)
W88-02656

COMBATTING ACID RAIN IN GERMAN POWERPLANTS,
Fichtner, Beratende Ingenieure fuer Energie- und Waermewirtschaft G.m.b.H. und Co. K.G., Stuttgart (Germany, F.R.)
P. Anton.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 64-74, 6 fig, 1 tab.

Descriptors: *Acid rain, *West Germany, *Powerplants, *Water pollution sources, *Water pollution prevention, Environmental protection, Costs, Legislation, Environmental effects.

Environmental pollution and damage is increasingly a topic of debate in Europe. The mutual proximity of the many countries means that the environmental damage caused by the transboundary travel of pollutants is a European and international problem, and not merely a national one. Faced with the alarming picture of dying lakes in Scandinavia and increasing damage to forests, property, and the health of their citizens, the countries of Europe are being urged to take effective countermeasures. A broad overview of developments and trends in the Federal Republic of Germany is presented through discussion of: (1) environmental damage through acid rain; (2) environmental protection legislation in West Germany; (3) measures to be adopted in powerplants; and (4) cost aspects of flue-gas desulfurization and deNOx installations. As Europe's biggest industrial nation, the Federal Republic of Germany has a trend-setting role in this issue. In terms of policy making and administration, and in the technical implementation of environmental protection measures, the FRG is at present the European leader, and will likely be the yardstick for other countries in the future. (See also W88-02650) (Lantz-PTT)
W88-02657

CONTROL ALTERNATIVES AND THE ACID RAIN ISSUE,
Electric Power Research Inst., Palo Alto, CA. Coal Combustion Systems Div.
K. Yeager.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 82-97, 6 fig, 5 tab.

Descriptors: *Acid rain, *Water pollution control, *Water pollution sources, *Water pollution prevention, Powerplants, Industrial pollution, Coal, Air pollution, Emissions control, Fluidized beds.

The term 'acidic deposition' was coined over 100 years ago; however, it was only recently that it aroused wide public awareness. One impact of this awareness has been a reexamination of the nation's historic, new-source-emissions control strategy under the Clean Air Act. Although this strategy has already resulted in a large reduction in emissions, the focus today is shifting from new plants to the more difficult problem of existing sources. This involves plants that will be at least 20 years old and will average over 30 under the schedule of proposed acid rain legislation. No single approach will satisfy the widely varying conditions in these plants. in addition, there are many nontechnical considerations in what may appear to be a simple technological choice, because such decisions can have profound impact on the affected states. Four categories of emissions-control options are in use or under development: fuel changes - coal cleaning, switching, or conversion; combustion process changes - NOx control, furnace sorbent injection, fluidized-bed combustion; flue-gas cleanup - wet and dry scrubbing; and, operational changes - emissions trading, early retirement, least-emission dispatch. Selection will depend on a number of variables: (1) These options differ significantly in their control potential; (2) their costs do not neatly match the progression of control efficiency; and (3) the variety of functional criteria that determine technical and economic capacities, duct configuration, space requirements, land and water availability, etc. This third category is a particularly important constraint when considering the retrofit of control technology to existing plants. Unlike new plants where powerplant and emissions controls are designed as an integrated system, retrofit requires adaptation of emissions controls to a plant typically not designed for such modification. This can lead to compromise and additional expense. (See W88-02650) (Lantz-PTT)
W88-02659

BURNING LOWER-SULFUR COALS TO REDUCE SO2 EMISSIONS,
ICF, Inc., Washington, DC.
D. E. Klein.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 100-111, 5 fig, 2 tab.

Descriptors: *Water pollution sources, *Acid rain, *Sulfur, *Coal, *Water pollution effect, Emissions control, Air pollution, Costs, Powerplants, Sulfur dioxide, Economic aspects.

Several means exist for reducing emissions of sulfur dioxide. Technological approaches, such as the retrofitting of flue-gas-desulfurization (FGD) systems, are intended to remove the sulfur dioxide during or after combustion. Other approaches seek to limit the amount of sulfur in the fuel prior to combustion and include the use of lower-sulfur coals, coal cleaning, and/or coal blending. For many powerplants, the most economical strategy for reducing sulfur dioxide emissions tends to be switching from higher-sulfur to lower-sulfur coals. Because the sulfur content in coal tends to vary across regions, this move to consume lower-sulfur coals would result in major shifts in regional coal production away from higher-sulfur supply regions (such as North Appalachia and the Midwest), and toward lower-sulfur supply regions (such as Central Appalachia and the Rockies). The magnitude of these potential shifts raises important questions as to regional econmic impacts, employment in the coal industry, and the ability of the coal industry to accommodate such changes. Included in this examination is an analysis of the potential costs of compliance, impacts on regional coal production, employment impacts, and potential near-term transitional constraints. (See also W88-02650) (Lantz-PTT)
W88-02660

COAL CLEANING: THE FIRST STEP,
L. Green.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 112-122, 5 fig, 3 tab, 23 ref.

Descriptors: *Acid rain, *Water pollution sources, *Coal, *Powerplants, *Water pollution prevention, Electric powerplants, Fluidized beds, Sulfur dioxide, Emissions control, Air pollution.

General acceptance of the fact that 'the cheapest electricity is not of necessity produced from the cheapest coal' has been slow, due in large part to institutional barriers inhibiting investment in preparation facilities. Nevertheless, all utilities are now seeking to increase the capacity and extend the operating life of existing plants, and are balancing these economic benefits from using cleaned coal against the cost of the cleaning operation itself. The assessment that 'the critical economic point in the coal energy system is the wash plant' is not an overstatement. Of the operational cost components involved, the largest is the loss of Btu value to the refuse stream, a factor which limits the 'depth' of cleaning economically practical. Another significant factor is the electric power required to drive the many mechanical operations involved in a preparation plant. A third factor now receiving increasing attention is disposal of the cleaning refuse, which constitutes a semi-hazardous waste, in an environmentally acceptable manner. Commercial technologies exist (1) for the cleaning of coal in aqueous physical operations, and (2) for burning the refuse in sulfur-capturing fluidized-bed combustors to improve the economics of electric-power generation while significantly reducing the emissions of SO2 thereby produced. Considering the ready availability of these mature technologies for immediate application, the Clean Coal Coalition rejects the premise that acid rain emissions control will cost American industry, particularly the electric-utility industry, billions of dollars. (See also W88-02650) (Lantz-PTT)
W88-02661

OPTIONS FOR REDUCING NOX, SO2 DURING COMBUSTION,
Babcock and Wilcox Co., Barberton, OH.
J. A. Barsin.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 136-152, 10 fig, 1 tab, 13 ref.

Descriptors: *Acid rain, *Sulfur dioxide, *Emissions control, *Nitrogen oxides, *Water pollution sources, *Combustion, Air pollution, Legislation, Water pollution prevention, Coal, Electric powerplants.

The increased public attention associated with air pollutants produced by stationary sources has resulted in clean air legislation in many states and at the federal level. State and federal standards, such as New Source Performance Standards (NSPS), have established maximum allowable emissions levels for gaseous pollutants from new sources. These standards are reviewed periodically to ensure that they reflect the best available control technology. Stationary sources established prior to NSPS are not, at present, subject to federal emissions regulations. However, proposed legislation could require many existing stationary sources to reduce emissions. The focus here is on coal combustion, NOx- and SOx-emissions reduction work (either demonstrated in the field or in the laboratory), and its applicability to existing sources. (See also W88-02650) (Lantz-PTT)
W88-02663

NONREGENERABLE WET FGD CONTROLS SO2 EMISSIONS,
J. F. Tearney, D. A. Froelich, and G. M. Graves.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 154-164, 6 fig.

Descriptors: *Flue-gas-desulfurization, *Acid rain, *Sulfur dioxide, *Water pollution sources, *Water pollution prevention, Air pollution, Costs, Chemical reaction, Lime, Limestone, Alkali, Reagents, Absorption, Waste disposal.

The Clean Air Act amendments of the 1970s forced coal-burning utilities and industries to reduce their emissions of sulfur dioxide. Nonregenerable wet flue-gas-desulfurization (FGD) systems were chosen by the first utilities trying to meet the new regulations. Since then, nearly every new coal-fired design has included a nonregenerable wet FGD system. The reasons are simple: high efficiency and cost-effectiveness. Although causality remains unclear, acid rain legislation may force utilities and some heavy industry to further reduce their sulfur dioxide emissions. Legislation may include strict controls on new units, retrofit requirements for existing sources, and upgrade demands on older FGD systems that have poor removal efficiencies or reliability problems. The industry will probably continue to turn to nonregenerable wet FGD systems, and for more good reasons than before. Today's reasons include high availability, versatility, and proven experience, as well as high efficiency and cost-effectiveness. Nonregenerable wet FGD is not the only possible answer. Specific conditions may, in fact, warrant another solution. But regardless of retrofit or upgrade, nonregenerable wet FGD systems should prove to be the most cost-effective answer for most installations. The effectiveness and economics of nonregenerable wet FGD systems will be examined herein and new developments in design and materials will be discussed. Briefly described is the chemistry on which are based the three basic types of nonregenerable wet FGD systems: lime, limestone, and dual-alkali. Also covered are the subsystems that comprise these systems: reagent preparation, SO2 absorption, and waste disposal. (See also W88-02650) (Lantz-PTT)
W88-02664

CONTROLLING ACID RAIN WITH DRY SCRUBBING,
Niro Atomizer A/S, Soeborg (Denmark).
K. Felsvang.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 165-183, 8 fig, 11 tab, 35 ref.

Descriptors: *Acid rain, *Water pollution sources, *Dry scrubbing, Water pollution prevention, Air pollution, Flue-gas-desulfurization, Economic aspects, Electric powerplants, Coal, Sulfur.

The concept of dry flue-gas-desulfurization (FGD) by spray-dryer absorption was developed during the mid-to-late 1970s. Acceptance by the utility industry has grown rapidly. Today, more than 8400 MW of dry scrubbers are in operation or under construction (6900 MW in the US, 1500 MW in Europe). The dry-scrubbing process has gained increasing popularity over the past five or six years because of the favorable overall economics. Tables show that the market trend for utility contract awards in the US. Several papers presented during the last year have made economic comparisons of wet vs dry FGD. A study sponsored by the Electric Power Reserch Institute showed that dry scrubbing would be competitive on a new 500-MW unit burning coal with a sulfur content up to 2.5%. However, a stoichiometric ratio of 1.25 was used for 90% removal. Based on recent developments, this is conservative and the breakeven point would increase to the 3.0-3.5% sulfur range. For typical eastern US coal-fired boilers with nominal 3.5% sulfur coal, several studies conclude that retrofit costs of a dry scrubber are up to 30% less expensive than for a limestone wet scrubber. (See also W88-02650) (Lantz-PTT)
W88-02665

SELECTING OPTIMUM CONTROL TO REDUCE ACID RAIN,
Ebasco Services, Inc., New York.
D. Kettler, R. Rao, B. Rossi, P. Nobile, and R. Cummings.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 184-196, 4 fig, 5 tab.

Descriptors: *Acid rain, *Water pollution control, *Network design, Water pollution prevention, Emissions control, Air pollution, Sulfur dioxide, Databases, Public policy, Legislation.

Cost factors, marginal environmental benefits expected, and an uncertainty in the relationship between acid deposition and receptors as presented by OMB, prompted President Reagan in his 1984 State of the Union address not to endorse any program to reduce emissions. Rather, the President called for doubling of funds for acid deposition research, restoring lakes affected by acid deposition, and the development of technology to reduce the precursors of acid deposition. The analysis presented here should be the first of many issues so that the entire range of uncertainties surrounding these key assumptions can be evaluated. With this analysis, a utility, power pool, or state can develop the database necessary to evaluate any acid rain emissions reduction strategy. The database, combined with the computer techniques described, will allow utilities to: provide area lawmakers and the rate-paying public with an accurate assessment of the cost implications associated with various SO2-emissions reduction proposals; distill results of an acid rain assessment program to recommend to Congress the most cost effective approach to limiting SO2 emissions; assess the cost of continued compliance beyond the 1995 compliance year, assuming various levels of utility growth; evaluate the potential impact acid rain regulations will have on plant life extensions and upgrading programs; and perform a sensitivity or uncertainty analysis for the key variables used in the base analysis, so that decisions are made based on a clear understanding of the potential impacts associated with changes in economic and regulatory environments. (See W88-02650) (Lantz-PTT)
W88-02666

USE REGENERABLE SCRUBBERS TO SLASH SO2 EMISSIONS,
United Engineers and Constructors, Inc., Philadelphia, PA.
R. R. Lunt, and J. S. MacKenzie.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 198-227, 7 fig, 5 tab.

Descriptors: *Acid rain, *Regenerable scrubbers, *Water pollution sources, *Water pollution control, *Sulfur dioxide, Emissions control, Wellman-Lord, West Germany, Sludge, Coal, Sulfur, Economic aspects.

The fact that only two regenerable processes, Wellman-Lord and MGO, have achieved commerical status, and limited commerical status at that, has in no way discouraged the search for new and possibly better regenerable fluidized-gas-desulfurization (FGD) processes. The driving force for this activity continues to be: avoidance of a sludge byproduct, recovery of the coal sulfur as a valuable byproduct, possibility of co-scrubbing NOx along with the SO2, and the possibility of improving economics relative to throwaway processes. At the present state of development, none of the new processes seems likely to achieve commercial acceptance before the late 1980s or early 1990s. Because, at best, regenerable processes are only competitive economically with the better-kown throwaway processes, and because the marketing of sulfur byproducts is regionall restricted, it is expected that they will continue to constitute only about 6% of the FGD market. Beyond this near-term outlook, increasing concern about land-filling byproduct sludge, with its potential for groundwater contamination, and greater emphasis on the recovery of a significant sulfur resources, may gradually lead to an increased market share for regenerable systems. (See also W88-02650) (Lantz-PTT)
W88-02667

GENERAL STATUS OF IGCC DEVELOPMENTS,
Electric Power Research Inst., Palo Alto, CA.
N. A. Holt, and T. P. O'Shea.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 228-250, 6 fig, 9 tab, 6 ref.

Descriptors: *Acid rain, *Integrated gasification combined-cycle, *IGCC, *Water pollution sources, Water pollution prevention, Costs, Economic aspects, Electric powerplants, Heat, Gasification, Air pollution.

The continued uncertainty surrounding nuclear-power deployment, the cost and availability of natural gas and oil, and environmental regulations argue strongly for the development of alternative coal-fueled power systems, especially coal gasification. The integrated gasification combined-cycle (IGCC) powerplant has the largest potential impact on the power industry. It promises reduced heat rates, lower water consumption and land requirements, markedly reduced emissions, and capital and electric power costs competitive with conventional coal-fired steam plants. IGCC plants in the 250-500 MW range will be comprised of several processing trains and gas turbines. This modular approach leads to high effective availability. A recent study conducted by Fluor Corp for the Electric Power Research Institute (EPRI) presents the results of current estimates of performance and costs for mature, Texaco-based IGCC powerplants. These plants - which employ a variety of gas-cooling options and advanced 2200 F gas turbines - exhibit the potential to provide significant reductions in the cost of electricity over conventional coal-fired steam plants, assuming both types of plants are to be operated at the same capacity factors. The EPRI study demonstrated that the use of low-level heat for fuel-gas saturation (as is practiced at Cool Water) provides an effective mechanism to improve system heat rate - particularly when both radiant and convective coolers are not included in the design. Also, fuel-gas saturation appears to be a far more efficient mechanism for NOx control than steam extraction for injection into the gas-turbine combustors. (See also W88-02650) (Lantz-PTT)
W88-02668

PRESSURIZED FLUIDIZED-BED COMBUSTION: A FUTURE OPTION,
American Electric Power Service Corp., Columbus, OH.
J. J. Markowsky.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 251-261, 6 fig, 5 tab.

Descriptors: *Pressurized fluidized-bed combustion, *Water pollution sources, *Air pollution, *Acid rain, Electric powerplants, Water pollution prevention, Coal, Sulfur.

The object here is to outline a development program that American Electric Power (AEP) has been involved in since 1976. The goal of this development program is to demonstrate the commerical readiness of a technology called pressurized fluidized-bed combustion (PFBC), which has the potential of providing the most economically and environmentally attractive method of utilizing high-sulfur coal for future electric power generation. The AEP system is the nation's largest single coal consumer, burning some 40-million tons/yr. Coal provides the energy source for approximately 86% of AEP's generating capacity. This dependence on coal has been the driving force behind AEP's efforts to refine conventional technology and develop new technologies to reduce sulfur emissions. These development programs have been geared to reduce sulfur emissions by either precombustion treatment (coal cleaning) or by treatment during combustion. (See also W88-02650) (Lantz-PTT)
W88-02669

TECHNIQUES FOR REDUCING NOX FROM COAL-FIRED UNITS,
Combustion Engineering, Inc., Chattanooga, TN.
M. S. McCartney, and M. B. Cohen.
IN: The Acid Rain Sourcebook. McGraw-Hill, Inc., New York, NY. 1984. p 262-283, 21 fig, 1 tab, 14 ref.

Descriptors: *Acid rain, *Nitrogen oxides, *Coal, *Water pollution sources, *Water pollution control, Air pollution, Water pollution prevention, Emissions control, Electric powerplants, LNCFS, MACT, Combustion.

The technology associated with the control of nitrogen oxides (NOx) from large steam generators has matured and expanded greatly in the last 12 years. In the years immediately following the Clean Air Act, NOx control was primarily confined to the redesign of burners and to some extent the reproportioning of furnaces; neither revision had substantial impact on the cost of new equipment. In 1984, the industry has seen not only the availability of some remarkable second-generation burner systems to prevent the formation of NOx, but the availability of both in-furnace and tail-end systems capable of reducing NOx after its formation. Unlike most of the early NOx-control devices, the current 'maximum control' technology can have a substantial effect on the intial and operating costs of both new and existing boilers. The NOx-control techniques presented in this discussion are systems which Combustion Engineering Inc (C-E) has developed internally or has been licensed to build by Mitsubishi Heavy Industries (MHI) of Japan. Each of the systems presented (retrofit OFA system, low-NOx concentric firing systems (LNCFS), and C-E/MHI-MACT (advanced combustion technology)), has a maximum percent NOx reduction which, in the opinion of C-E, represents the maximum technical or economic limits for that technology. The degree of NOx control is compared to a base of 100%, which would be typical of pre-NSPS tangential-fired units designed in the mid-to-late 1060s. For retrofit applications, the degree of NOx control will vary somewhat from the values presented, depending on the physical restrictions and compromises required. (See also W88-02650) (Lantz-PTT)
W88-02670

BIOLOGICALLY BASED WATER QUALITY MANAGEMENT,
Anglian Water Authority, Lincoln (England). Lincoln Div.
For primary bibliographic entry see Field 5C.
W88-02692

HAZARDOUS WASTE MANAGEMENT PROGRAM UNDER THE RESOURCE CONSERVATION AND RECOVERY ACT.
Cleary, Gottlieb, Steen and Hamilton, Washington, DC.
For primary bibliographic entry see Field 6E.
W88-02760

METHODS OF IMMOBILIZING SOIL CONTAMINATION (METHODEN ZUR IMMOBILISIERUNG VON BODENKONTAMINATIONEN),
Envi-Sann G.m.b.H., Schmitten (Germany, F.R.).
M. Stammler, and H. J. Hass.
Chemieingenieurtechnik CITEAH, Vol. 59, No. 5, p 393-396, 1987. 1 fig, 7 ref.

Descriptors: *Groundwater pollution, *Grouting, *Water pollution control, *Water pollution prevention, *Waste dumps, *Silica, *Gels, Landfills, Waste storage, Industrial wastes, Leachates, Bentonite, Sanitary engineering.

A number of remedial measures can be applied in order to contain or immobilize contaminants which threaten to pollute groundwater, soil or air. Some are still conceptual in character, others are in practical use. So far, bentonite/cement-based slurry walls have often been constructed to regulate the groundwater flow in contaminated areas. In general, clay layers are used as a bottom seal whenever available. However, investigations have shown that conventional and many natural materials do not exhibit the resistance to aggressive leachates which is necessary to retain contamination over extended periods of time. In the proposed concept a partial or complete encapsulation of the contamination is recommended, using barriers resistent to aggressive leachates. This can be achieved by new silica gel containing materials and in some cases by suitable geotextiles. Extensive tests of such materials are presently under way at various abandoned waste sites in the F. R. Germany. Remedial action can then be planned and executed to decontaminate the site in ample time without risk of further contamination. New results are reported, obtained during a one-year test period with water glass of low alkalinity and high SiO2/Na2O ratio. Their resistance to leachates, low syneresis, and high hardness were achieved by the two-component system Dynagrout PPN + DWR, developed by Dynamit Nobel. (Author's abstract)
W88-02814

PERCENTILE ESTIMATION FOR WATER QUALITY DATA,
WRC Engineering, Swindon (England).
For primary bibliographic entry see Field 5D.
W88-02829

ROLE OF WOODY VEGETATION IN PREVENTING GROUND WATER POLLUTION BY NITROGEN FROM SEPTIC TANK LEACHATE,
Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
For primary bibliographic entry see Field 5D.
W88-02832

NEW ROLE FOR THE STATES IN WATER POLLUTION CONTROL FINANCING,
For primary bibliographic entry see Field 6E.
W88-02842

LOGISTICS OF OIL SPILL DISPERSANT APPLICATION, VOLUME I: LOGISTICS - RELATED PROPERTIES OF OIL SPILL DISPERSANTS,
Transportation Systems Center, Cambridge, MA.
For primary bibliographic entry see Field 5B.
W88-02887

LOGISTICS OF OIL SPILL DISPERSANT APPLICATION, VOLUME II: APPLICATION TECHNIQUES, STOCKPILING, DISPERSANT SELECTION, STRATEGIES,
Transportation Systems Center, Cambridge, MA.
J. Bellantoni.
Available from the National Technical Information Service, Springfield, VA 22161, as ADA-123019, A07 in paper copy, A01 in microfiche. CG-D-38-82, II, November 1982. Final Report. 126 p, 23 fig, 22 tab, 9 ref, 2 append.

Descriptors: *Oil spills, *Cleanup operations, *Dispersants, Oil pollution, Marine environment, Marine resources, Surfactants, Environmental protection, Water pollution control.

The logistics of oil dispersant application by the U.S. Coast Guard are explored. Although the use of chemicals for oil spill dispersal is not widespread in the U.S., it has implications for the U.S. Coast Guard's marine environmental protection program. Volume Two presents formulae and charts for analyzing single and multiple-pass application; factors in stockpiling. Six operational strategies, consisting of choices of vehicles, stock piles and dispersants, are formulated and evaluated. (See also W88-02887) (Author's abstract)
W88-02888

EXPERIMENTS AND EXPERIENCES IN BIOMANIPULATION - STUDIES OF BIOLOGICAL WAYS TO REDUCE ALGAL ABUNDANCE AND ELIMINATE BLUE-GREENS,
Minnesota Univ., Minneapolis. Limnological Research Center.
J. Shapiro, B. Forsberg, V. Lamarra, G. Lindmark, and M. Lynch.
Available from the National Technical Information Service, Springfield, VA 22161, as PB83-148098, A12 in paper copy, A01 in microfiche. EPA-600/3-82-096, December 1982. 251 p, 90 fig, 43 tab, 194 ref.

Descriptors: *Water quality control, *Lake restoration, *Algae, *Nutrients, Aquatic life, Fish, Zooplankton, Cyanophyta, Chlorophyta, Biomanipulation, Phosphorous, Aeration, Water circulation, Carbon dioxide, Eutrophic lakes, Species composition.

The process of biomanipulation (controlling the external sources of nutrients) has been studied in several Minnesota lakes as a means of lake restoration and management. The abundance of algae can be substantially varied by one or more of the following procedures: (1) elimination of benthivorous fish which recycle phosphorous from sediments, (2) manipulation of algal populations by lowering pH, causing artificial circulation, or stimulating algal viruses, and (3) increasing abundance of larger herbivorous zooplankton by reducing predation on them, by eliminating planktivores entirely, or by providing refuges from planktivores. In pH lowering experiments addition of carbon dioxide with nitrogen and phosphorous produced a shift in algal populations from blue-green to green. The shift occurred at pH of 5.5 to 8.5 when carbon dioxide was the acid added and at 5.5 to 7.5 when HCl was used. The shift from blue-green to green was more rapid in spring and fall than in summer. Lake water aeration was more successful in eutrophic lakes with lower alkalinity. The most important factors involving the response of algal populations to aeration were mixed depth and total phosphorous, which have opposite effects on the maximum concentration of chlorophyll in the mixed layer during circulation. (Cassar-PTT)
W88-02890

MICROBIOLOGICAL WATER QUALITY OF IMPOUNDMENTS: A LITERATURE REVIEW,
Texas Univ. at Dallas, Richardson. Center for Environmental Studies.
For primary bibliographic entry see Field 5A.
W88-02892

FEASIBILITY STUDY TO UTILIZE LIMING AS A TECHNIQUE TO MITIGATE SURFACE WATER ACIDIFICATION,
General Research Corp., McLean, VA.
J. Fraser, D. Hinckley, R. Burt, and R. R. Severn.
Available from the National Technical Information Service, Springfield, VA 22161, as DE82-903668, A06 in paper copy, A01 in microfiche. EPRI-EA-2362, Interim Report, April 1982. 58 p, 6 fig, 6 tab, 104 ref, 2 append. Project No. 1109-14.

Descriptors: *Lime, *Acidic water, *Water quality control, *Fisheries, *Neutralization, Water quality, Water quality management, Calcium carbonate, Metals, Ecological effects, Aquatic populations.

The feasibility of liming as a technique for mitigating surface water acidification as a fisheries management technique was studied by reviewing

liming operations in Scandinavia, Norway, and Canada. Crushed limestone is much less expensive and less caustic than either CaO or Ca(OH)2. However, it takes more CaCO3 to neutralize acidic water. The amount of alkaline material required varies according to the volume and flushing rate of the lake, the base exchange capacity of the sediments, and the type of limiting material used. The application techniques used to disperse liming materials vary according to the equipment or system used and/or the target areas it is being applied to. Insufficient data exists for conducting a cost/benefit analysis of liming operations. Liming causes a long-term decrease in water transparency and depth of the late summer epilimnion and thermocline and an increase in pH, alkalinity, Ca and hardness. Changes in metal concentrations have also been attributed to liming along with disruptions in nutrient cycling. Liming causes an initial decline in the biomass of lower trophic levels, a gradual increase in biomass and bacterial populations, death of acidophilic populations, fish mortality due to precipitation of toxic metals, and enhancement of fish reproduction and sac fry survival. Additional research to evaluate liming is required. (Geiger-PTT)
W88-02898

PROTECTING THE NATION'S GROUNDWATER FROM CONTAMINATION, VOLUME I.
Office of Technology Assessment, Washington, DC.
OTA-0-233, October 1984. 244 p, 6 fig, 40 tab, 184 ref.

Descriptors: *Water quality control, *Groundwater pollution, *Water pollution sources, *Water pollution prevention, Protection, Water pollution effects, Public health, Fate of pollutants, Chemical wastes, Toxicity, Economic impact, Environmental effects, Social impact, Political aspects, Federal jurisdiction, State jurisdiction, Regulations, Standards, Water law, Legal aspects, Nonpoint pollution sources, Water quality standards, Geohydrology, Monitoring, Sampling, Water analysis, Pollutant identification, Drinking water, Water treatment, Landfills, Aquifers.

The current status of knowledge and experience in dealing with groundwater contamination is assessed. Overall, much information on pollution sources, impacts and technology is available. However, Federal and state programs have somewhat limited ability to protect groundwater quality. Although the extent of groundwater contamination is small, it is significant because it generally occurs in heavily populated areas. Much information is available on the public health effects of pollution, but little is available on the impacts of agricultural productivity, the environment, and industries needing high-quality water. Existing Federal and state laws and programs to protect groundwater quality are summarized. There is no explicit, comprehensive national legislative mandate to protect groundwater from pollution. All states have groundwater contamination to some degree. They deal with these problems with varying success. States give more attention to point sources, rather than nonpoint sources, and to prevention, rather than detection or correction. Techniques for hydrogeologic investigations of groundwater contamination are given. Federal and state efforts to detect groundwater contamination include aquifer studies, drinking water monitoring, assessing potential pollution sources, and monitoring in the vicinity of contamination sites. On the state level, contamination is detected principally through inventories, source monitoring, water supply monitoring, and ambient water quality monitoring. Techniques for correction and prevention of groundwater contamination, as well as federal and state efforts are discussed. (Cassar-PTT)
W88-02950

PROTECTING THE NATION'S GROUNDWATER FROM CONTAMINATION, VOLUME II.
Office of Technology Assessment, Washington, DC.
OTA-0-276, October 1984. 503 p, 8 append.

Descriptors: *Water quality control, *Groundwater pollution, *Water pollution sources, *Water pollution prevention, Protection, Water pollution effects, Public health, Fate of pollutants, Chemical wastes, Toxicity, Environmental effects, Political aspects, Federal jurisdiction, State jurisdiction, Regulations, Standards, Water law, Legal aspects, Nonpoint pollution sources, Water quality standards, Geohydrology, Monitoring, Drinking water, Aquifers, Landfills, Water treatment, Monitoring.

This volume contains the appendixes to Volume I. Included under groundwater contamination and its impacts are lists of health risks of chemicals, toxic effects of chemicals, frequency of detection of chemicals, substances detected at levels exceeding standards, and sources of groundwater contamination. Terms used in hydrogeologic investigation are defined in a glossary. Monitoring provisions for Category Sources I-VI are listed. The appendix on corrective action includes conditions (technical and nontechnical) determining the applicability of corrective action alternatives and application of corrective action alternatives to specific sources. Additional appendixes supplement the information in Volume I on federal and state institutional frameworks to correct and prevent groundwater contamination. (Cassar-PTT)
W88-02951

MULTIVARIATE WATER QUALITY INDEX FOR USE IN MANAGEMENT OF A WILDLAND WATERSHED,
Utah Center for Water Resources Research, Logan.
R. Mahmood, and J. J. Messer.
Water Resources Planning Series UWRL/p-82//08, November 1982. 57 p, 11 fig, 23 tab, 90 ref. Contract No. 14-34-0001-8407. Project No. C-80129-P.

Descriptors: *Water quality control, *Environmental effects, *Model studies, *Watershed management, *Aquatic life, *Idaho, Mountain watersheds, Blackfoot River, Water quality index, Multivariate analysis, Streams, Invertebrates, Statistical analysis, Environmental policy, Planning, Logging, Grazing, Mineral industry, Linear programming, Species composition, Benthic fauna.

Multivariate statistical techniques were used to define a method for establishing a water quality index for use in protecting the stream environment in a high mountain watershed. The purpose of the water quality index was to aggregate water quality parameters in such a way that the effects of low level increments in mining, grazing, logging, and other activities could be related to a change in the value of a single entity, aquatic environmental quality, in a linear programming management model. Several data aggregation methods were explored, using water quality data collected over 5 years (1975-1979) by the USDA Forest Service in the upper Blackfoot River watershed in southeastern Idaho. The water quality indexes thus generated were compared with indexes of benthic invertebrate community composition as determined from samples collected late in the summer of 1981. Community composition indexes were based on emergent community properties (biomass and diversity) and on taxonomic composition as revealed by principal components analysis. (Author's abstract)
W88-02959

EVALUATING STRATEGIES FOR GROUNDWATER CONTAMINANT PLUME STABILIZATION AND REMOVAL,
Geological Survey, Menlo Park, CA. Water Resources Div.
S. M. Gorelick, and B. J. Wagner.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. Supt Doc, USGPO, Wash, DC 20402. In: USGS Water-Supply Paper 2290, 1986. p 81-90, 7 fig, 11 ref.

Descriptors: *Groundwater contamination, *Groundwater pollution, *Water pollution treatment, Groundwater, Groundwater management, Groundwater modeling.

Optimal remedial alternatives for contaminated aquifers can be selected using combined simulation-management models. Such models identify the best selection of wells and pumping or recharge rates that serve to stabilize contaminant plumes. Plume containment may be accomplished with pumping and recharge wells that control the hydraulic gradient at the perimeter of a plume. The methodology is applied to a hypothetical system in which contaminated groundwater must be isolated and removed. Emphasis is placed on experimenting with a menu of design considerations to identify solutions to site-specific problems of aquifer restoration. (USGS)
W88-03118

MICROBIAL SULFATE REDUCTION IN EXTREMELY ACID LAKES,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
A. E. Konopka, R. A. Gyure, W. Doemel, and A. Brooks.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-167723/AS. Price codes: A04 in paper copy, A01 in microfiche. Technical Report 173. October 1985. 50 p, 16 tab, 8 fig, 34 ref. Contract No. 14-08-0001-G905. Project No. USGS G905-06.

Descriptors: *Acid mine water, *Acid lakes, *Strip mines, *Fate of pollutants, *Water pollution control, *Indiana, Microbes, Algal nutrition, Sulfate.

Microbial metabolism in Reservoir 29, an acid (pH 3) strip mine lake in Green-Sullivan State Forest, Indiana was studied. Algal productivity was relatively low, presumably because of the poor nutritional status of the lake. Algal species diversity was also very low--only four algal species were found in significant numbers in the lake. Bacterial sulfate reduction in the sediments of Reservoir 29 was extensively studied, because this process can neutralize acidity. In situ rates ranged from 0.012 - 0.142 micromoles H2S/ml of sediment/day, these values were comparable to those found in some pH-neutral habitats and were higher than those found in a nearby lake which had a sediment pH of 6.2. The reduction of sulfate was biologically mediated, because it had a temperature optimum of 37 C. As a result of sulfate reduction in the sediments, H2S concentrations in the hypolimnion reached values greater than 1 mm, and the pH at the sediment-water interface increased more than 1 unit during the summer. The pH optimum for sulfate reduction was 5. Samples adjusted to pH 7 were initially inhibited but recovered within 24 h to reduce sulfate at rates greater than those found at pH 3. Hydrogen gas was the only electron donor that stimulated sulfate reduction at pH 3; organic acids, which are important electron donors for sulfate reduction in pH-neutral habitats, were very toxic at pH 3. (USGS)
W88-03174

BIODEGRADATION OF HAZARDOUS CHEMICAL WASTES,
Louisiana State Univ. Medical Center, New Orleans.
For primary bibliographic entry see Field 5D.
W88-03180

PUBLIC RESPONSE TO THE DISCOVERY OF WATER CONTAMINATION,
New Hampshire Univ., Durham. Dept. of Sociology.
For primary bibliographic entry see Field 6G.
W88-03187

INVESTIGATIONS INTO THE USE OF LIMESTONE TO COMBAT ACIDIFICATION IN TWO LAKES IN WEST WALES,
Welsh Water Authority, Powys.
J. Underwood, A. P. Donald, and J. H. Stoner.
Journal of Environmental Management JEVMAW, Vol. 24, No. 1, p 29-40, January 1987. 5 fig, 3 tab, 28 ref.

Descriptors: *Limestone, *Acidification, *Acidic water, *Wales, *Lakes, *Water quality management, *Chemical analysis, *Acid rain effects,

*Lake restoration, Water quality, Calcium, Hydrogen ion concentration, Acidity.

Limestone investigations were conducted in two acid lakes in West Wales that had mean pH values of 4.2 and 4.8 before liming. Before treatment, laboratory tests were carried out using lake water to determine the most suitable dosing material and the optimum application rate. In order to improve water quality to pH >5.5 for a reasonable period of time, it was necessary to overdose to pH 7.0, given the diluting effects of acid streams. The projected decay of pH and calcium concentrations during natural lake flushing was simulated by diluting limestone-dosed lake samples with raw lake water. The time for the pH to fall to 5.5 could then be calculated from the catchment hydrology of each lake. Following liming in April 1985, maximum pH readings of 6.9 and 7.0 were achieved in the two lakes. Water quality has subsequently behaved essentially as predicted, although one lake has re-acidified more rapidly than expected. Although the technique described has proven effective and economical, the ecological consequences are still under evaluation, as are alternative techniques such as catchment liming. (Doria-PTT)
W88-03213

OPTIONS FOR MANAGING UNDERGROUND STORAGE TANKS,
Virginia Water Resources Research Center, Blacksburg.
M. S. Hrezo.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 1-17, 3 tab, 12 ref.

Descriptors: *Water quality management, *Underground storage, *Petroleum products, *Groundwater pollution, *Groundwater, Storage, Water pollution, Water pollution prevention, Water pollution control, Environmental protection, Water quality, Leakage, Hazardous materials, Economic aspects, Groundwater quality, Drinking water.

Groundwater quality in the United States is threatened by leaking underground petroleum storage tanks located both at retail service stations and on farms, private residences, commercial enterprises, and industries. Most underground storage tanks were buried over 20 years ago and have no corrosion protection. These tanks are capable of causing extensive damage to groundwater resources and great expense and inconvenience to industry and those depending on groundwater as the source of their drinking water. Environmental, health, and cost considerations combine to demonstrate the importance of preventing leaks from underground petroleum product storage tanks. Some appropriate goals for an underground storage tank management program, changes in RCRA requiring regulation of underground tanks, and eleven existing state programs for managing underground storage of petroleum products were reviewed. Three options for managing underground tanks are presented and their advantages and disadvantages are discussed. (See also W88-03223) (Wood-PTT)
W88-03224

REGULATION REVIEW FOR UNDERGROUND STORAGE TANKS,
Wiley and Wilson, Inc., Lynchburg, VA.
For primary bibliographic entry see Field 6E.
W88-03225

UNDERGROUND INDUSTRIAL WASTE TANK (UIWT) RELEASES: THE MAGNITUDE OF THE PROBLEM - CLEANUP AND LIABILITY COST ESTIMATING MODEL,
SCS Engineers, Inc., Reston, VA.
J. D. Wright, J. L. Briggs, and R. W. Luce.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 31-43, 7 fig, 7 ref.

Descriptors: *Water quality management, *Underground storage, *Petroleum products, *Model studies, *Costs, *Cleanup operations, Groundwater pollution, Groundwater, Storage, Water pollution, Water pollution prevention, Water pollution control, Environmental protection, Water quality, Economic aspects, Legal aspects, Leakage, Hazardous materials.

New Federal law directs the U.S. Environmental Protection Agency (EPA) to develop a comprehensive regulatory program for underground storage tanks including underground industrial waste tanks (UIWTs) holding petroleum or hazardous substances. By February 1987 the EPA was scheduled to prescribe leak detection and leak reporting requirements for all tanks, in addition to clarifying a tank owner's financial responsibility for damage claims and environmental clean-up after a leak. A model was developed which allows the manufacturing, petroleum and chemical industries, financial and insurance institutions, and regulatory agencies to gain some insight into the potential magnitude of the environmental cleanup related to underground storage tanks and the third party liability problem from a financial perspective. The model estimates the number of underground storage tank systems on a national level that may be leaking and the cost of UIWT release incident cleanup and liability costs. (See also W88-03223) (Wood-PTT)
W88-03226

EFFECTS OF EXTENDED IDLE PERIODS ON HAZARDOUS WASTE BIOTREATMENT,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W88-03229

BIOLOGICAL TREATMENT OF SIMULATED LANDFILL LEACHATE CONTAINING CHLORDANE,
Memphis State Univ., TN. Dept. of Civil Engineering.
J. W. Smith, L. W. Moore, and D. A. Sabatini.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 157-169, 5 fig, 4 tab, 11 ref.

Descriptors: *Wastewater treatment, *Activated rotating biological contactor, *Biological wastewater treatment, *Hazardous materials, *Water pollution treatment, *Leachates, *Landfills, *Chlordane, Industrial wastewater, Load distribution, Organic loading, Waste load, Wastewater, Biological oxygen demand.

In an attempt to treat hazardous waste streams from industrial sources and landfill sites effectively and economically, investigation of innovative treatment alternatives is essential. One such process, the activated rotating biological contactor (ARBC) process which includes a rotating biological contactor followed by an aeration basin and final clarifier with sludge recycle from the clarifier to the fixed film media, was detailed. The operating data presented showed: (1) that the ARBC was capable of high organic removal at loading rates of 1.59 and 1.54 kg/cu m/day which exceed the recommended loading rates for the conventional biological contactor of 0.48 to 0.96 kg/cu m/day; (2) that high organic removal as evidenced by BOD5 removal efficiencies of 95-99%, consistent specific oxygen uptake rates, and consistent mixed liquor suspended solids values were obtained even during system upset and introduction of varying levels of chlordane; and (3) that chlordane removal of 75-96% was realized even during system upset at the BOD5 levels of 175 and 500 mg/L and chlordane levels of 0.0 to 5.0 mg/L. These parameters demonstrated the highly desirable operating characteristics of the ARBC system even under adverse operating conditions and when exposed to varying concentrations of a hazardous material. (See also W88-03223) (Wood-PTT)
W88-03234

TREATMENT OF A LANDFILL LEACHATE IN POWDERED ACTIVATED CARBON ENHANCED SEQUENCING BATCH BIOREACTORS,
Occidental Chemical Corp., Grand Island, NY. Research Center.
W.-C. Ying, R. R. Bonk, and S. A. Sojka.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 170-186, 4 fig, 8 tab, 19 ref.

Descriptors: *Wastewater treatment, *Activated carbon, *Sequencing batch reactors, *Water pollution treatment, *Bio-physical wastewater treatment, *Adsorption, Wastewater, New York, Economic aspects, Leachates, Biodegradation, Biological wastewater treatment, Bacteria.

The wastewater treatment method presently used at the Hyde Park Landfill site in New York is the conventional adsorption technology which, although producing a suitable quality effluent, is not the best long-term solution since it would have to be expanded substantially to handle the expected wastewater volume increase; the cost forecast for carbon absorption also provides a strong economic incentive to explore other methods. Addition of powdered activated carbon (PAC) to the aeration tank of an activated sludge system provided many benefits including a higher degree of organic removal, better settling sludge with excellent dewaterability, improved nitrification, more resistance to shock loadings of wastewater constituents and/or flowrate. Because of the successful bench- and pilot-scale treatment of Hyde Park leachate in sequencing batch reactors (SBRs) and the high absorptive capacities of activated carbon for the leachate constituents, the bio-physical PAC enhanced SBR (PAC-SBR) wastewater treatment technology was explored. The addition of PAC significantly improved the waste treatment performance of SBRs. Because of the concurrent dual organic removal mechanisms (adsorption of persistent compounds on PAC and biodegradation by the mixed culture bacteria) in the SBR units, the effluents met very stringent limits on a broad spectrum of parameters. Concentrations of many of the monitored halogenated organic compounds in the effluent were below their respective detection limits. The treatment costs of the integrated process is substantially lower than either that of the granular activated carbon process or the two-stage process of biotreatment in SBR followed by carbon adsorption. Efficiency of the PAC-SBR under a variety of operating conditions was detailed. (See also W88-03223) (Wood-PTT)
W88-03235

LOW TEMPERATURE THERMAL STRIPPING OF VOLATILE COMPOUNDS – A FIELD DEMONSTRATION PROJECT,
Weston (Roy F.), Inc., West Chester, PA.
For primary bibliographic entry see Field 5E.
W88-03237

REDUCTION OF TOTAL TOXIC ORGANICS IN METAL FINISHING WASTEWATER – ALTERNATIVE PAINT STRIPPERS,
Carltech Associates, Inc., Cranford, NJ.
P. Werschulz.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 348-356, 6 tab, 3 ref. EPA Contract No. 68-03-3257.

Descriptors: *Paint strippers, *Metal-finishing wastes, *Water pollution prevention, *Water pollution control, *Methylene chloride, *Hazardous materials, Industrial wastewater, Industrial wastes, Wastewater, Organic compounds.

In the metal-finishing industry old paint is frequently removed in refurbishing operations, defective new paint is stripped before refinishing, and paint build-up on assembly line apparatus and spray booths must be cleaned off. Paint stripping chemicals, including methylene chloride which has been designated a hazardous material by the Consumer Product Safety Commission, enter metal finishing wastewater through dragout and rinsing operations. The simplest and least expensive strate-

gy for reducing the amount of methylene chloride in industrial wastewater is to substitute a paint stripper which is more environmentally acceptable and contains less methylene chloride or other materials which are monitored and reported as part of the facility's Total Toxic Organics included in their discharge permit. Ten cold organic paint strippers were tested on aluminum or steel panels treated with enamel, epoxy or polyamide paints on various primers and the results were compared with those for MS-111 which was used by the Army and contained 85% methylene chloride and 10% phenol. It was found that of the strippers tested, only those containing methylene chloride, phenol and an organic acid effectively removed the top coat of paint from all the paint samples using a submersion time of 20 minutes. Alternatives for facilities using enamels or heated stripper tanks and possible methylene chloride dilution were discussed. (See also W88-03223) (Wood-PTT)
W88-03247

ACTIVATED SLUDGE TREATMENT AND SALT MARSH POLISHING FOR SEAFOOD PROCESSING WASTEWATER: AN EXPERIMENTAL INVESTIGATION,
Lehigh Univ., Bethlehem, PA. Center for Marine and Environmental Studies.
For primary bibliographic entry see Field 5D.
W88-03250

ENHANCEMENT OF BIODEGRADATION OF ALCOHOLS IN GROUNDWATER SYSTEMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
W. G. Wilson, J. T. Novak, and K. D. White.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 421-430, 6 fig, 2 tab, 2 ref.

Descriptors: *Groundwater pollution, *Water quality control, *Alcohols, *Groundwater quality, *Biodegradation, *Water pollution treatment, *Alcohol biodegradation, *Water quality, *Water pollution control, Bacteria, Pollutants, Methanol, Tertiary-butanol, Hazardous materials, Soil bacteria, Groundwater, Hydrogen ion concentration, Aquifers.

Subsurface bacteria are capable of slowly degrading organic compounds in groundwater; if this natural biodegradation rate could be increased, then more expensive physical-chemical treatments may be unnecessary. The potential for enhancement of biodegradation of methanol, which is readily biodegraded, and tertiary-butyl alcohol (TBA), which is degraded very slowly in groundwater systems, was investigated. In some instances, nitrate addition enhanced the natural biodegradation of methanol in groundwater although this effect was not usually noted for TBA degradation. Aquifer characteristics also affected degradation rate and the choice of treatment. Low pH and/or low aquifer alkalinity could cause slow alcohol degradation which would be exacerbated by the addition of nitrate. On the other hand, if the pH of the water was above 7.0, addition of nitrate should enhance methanol removal and may enhance TBA degradation. (See also W88-03223) (Wood-PTT)
W88-03255

THREE SCREENING TESTS FOR THE EVALUATION OF GROUNDWATER QUALITY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
A. S. McDowell, and G. D. Boardman.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 472-488, 5 fig, 2 tab, 8 ref.

Descriptors: *Groundwater quality, *Water quality, *Testing procedures, *Water analysis, *Screening tests, *Groundwater, Microtox bioassay, Biochemical tests, Bioassay, Bacteria, Aquatic bacteria, Organic compounds, Sensitivity analysis.

The effectiveness of Total Organic Halogen (TOX), Total Organic Carbon (TOC), and Microtox bioassay as screening procedures for groundwater quality was determined by correlation of Microtox bioassay results obtained for all field samples with chemical analysis (including TOX and TOC) reported in the USDA Groundwater sampling project. The Microtox bioassay is based on the relative luminescence of the marine bacterium, Photobacterium phosphoreum, which are specially grown and harvested by Beckman Instrument, Inc. to insure genetic stability and to minimize differences in bacterial batches. The Microtox bioassay, which was developed as an alternative to fish bioassays, is rapid, simple, inexpensive, sensitive, reproducible, and unaffected by hardness, sulfate, chloride, and fluoride at concentrations of 150 milligrams/liter (mg/L), 28 mg/L, 61 mg/L, and 6.7 mg/L, respectively. The Microtox bioassay was most sensitive to the organics tested at 10 degrees C and a five minute exposure period though the maximum sensitivity varied widely with the toxicity of the compound tested, ranging from 0.1 mg/L for parachlorophenol to 2.7 mg/L for phenol and 4.1 mg/L for benzene. The Microtox bioassay should not be used to screen chlorinated samples unless they are first dechlorinated. It was concluded that the Microtox bioassay can be a useful tool for the evaluation of groundwater quality and TOC and TOX can complement the Microtox results. The three tests are recommended for the evaluation of groundwater quality. (See also W88-03223) (Wood-PTT)
W88-03260

ANOXIC TRANSFORMATIONS OF TRACE HALOGENATED ALIPHATICS,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W88-03265

WASTEWATER CHARACTERIZATION AND TREATMENT FOR THE COAL SLURRY PIPELINING INDUSTRY,
Arkansas Univ., Fayetteville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W88-03270

ADVANTAGES OF NONPARAMETRIC PROCEDURES FOR ANALYSIS OF WATER QUALITY DATA,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03276

TRACE METALS IN SAN FRANCISCO BAY, CALIFORNIA: A PRELIMINARY REPORT,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W88-03314

EXAMPLE EVALUATION OF A PERMIT APPLICATION FOR A PROPOSED HAZARDOUS-WASTE LANDFILL IN EASTERN ADAMS COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
E. R. Banta.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4131, 1986. 17 p, 4 fig, 4 tab, 11 ref.

Descriptors: *Hazardous materials, *Landfills, Hydraulic conductivity, Flow velocity, Adams County, Colorado.

A project was undertaken by the U.S. Geological Survey in cooperation with the U. S. Environmental Protection Agency to demonstrate methods by which RCRA (Resources Conservation and Recovery Act of 1976) Part B permit applications might be evaluated. The purpose of the project was to prepare a report that would supplement a series of case studies to be made available to permit writers in the U.S. Environmental Protection Agency. Four sites in the United States were chosen for their potential applicability to geologically similar sites. The Adams County, Colorado, site was chosen to be representative of sites in the Upper Cretaceous Pierre Shale. The intent of this report is to provide an example of how available earth-science information might be used in evaluating an application and not to evaluate the acceptability of the site. Because this study is an evaluation of a permit application, the data used are limited to the data supplied in the application and in published reports. Of the five criteria required by the U.S. Environmental Protection Agency to be addressed in the permit application considered in the case study, the application was evaluated to be inadequate in addressing three criteria: (1) Site characterization, (2) ability to monitor the location, and (3) flow paths and 100-foot time of travel. Details of the inadequacies and a description of the information needed to eliminate the inadequacies are included in the report. (USGS)
W88-03332

RECORDS OF WELLS, TEST BORINGS AND SOME MEASURED GEOLOGIC SECTIONS NEAR THE WESTERN NEW YORK NUCLEAR SERVICE CENTER, CATTARAUGUS COUNTY, NEW YORK,
Geological Survey, Ithaca, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03384

LAND SUBSIDENCE IN THE SANTA CLARA VALLEY, CALIFORNIA, AS OF 1980,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03412

EFFECTS OF SANITARY SEWERS ON GROUND-WATER LEVELS AND STREAMS, NASSAU AND SUFFOLK COUNTIES, NEW YORK. PART 3--DEVELOPMENT AND APPLICATION OF SOUTHERN NASSAU COUNTY MODEL,
Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03450

WATER-QUALITY ASSESSMENT AND WASTEWATER-MANAGEMENT ALTERNATIVES FOR DARDENNE CREEK IN ST. CHARLES COUNTY, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
W. R. Berkas, and J. R. Lodderhose.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4120, 1985. 51 p, 14 fig, 10 tab, 17 ref.

Descriptors: *Wastewater treatment, *Waste-assimilative capacity, *Simulation *Missouri, Oxygen demand, Dissolved oxygen, Computer models, Ammonia, Water quality, Dardenne Creek, St. Charles County.

The quality of water in the 15 mile downstream reach of Dardenne Creek in St. Charles County, Missouri, was assessed to determine if it met the Missouri water quality standards. Concentrations of dissolved oxygen and total ammonia failed to meet water quality standards downstream from the Harvester-Dardenne and St. Peters Wastewater-Treatment Plants. The QUAL-II SEMCOG water quality model was calibrated and verified using two independent data sets from Dardenne Creek. Management alternatives using current, design capacity, and future expansion wastewater discharges from the St. Peters Wastewater-Treatment Plant were evaluated. Results of the computer simulation indicate that a nitrification-type advanced-treatment facility installed at the plant would produce a 5-day carbonaceous biochemical oxygen demand of 10 mg/L. An effluent limit of 5.0 mg/L of 5-day carbonaceous biochemical oxygen demand would

further improve the water quality of Dardenne Creek; however, an additional treatment process, such as sand filtration, would be needed to meet this criterion. (USGS)
W88-03467

AQUIFER TESTS AT THE JACKPILE-PAGUATE URANIUM MINE, PUEBLO OF LAGUNA, WEST-CENTRAL NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03468

ASSESSMENT AND COMPILATION OF GROUND-WATER QUALITY DATA FOR MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7C.
W88-03485

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

COMPUTERIZED HYDROPOWER PLANNING IN LATIN AMERICAN COUNTRIES,
SM-Latinamerica, Lima (Peru).
S. Morariu.
International Water Power and Dam Construction IWPCDM, Vol. 39, No. 7, p 26-28, July 1987. 2 tab, 2 ref.

Descriptors: *Model studies, *Reviews, *Water resources development, *Dams, *Hydroelectric power, *Planning, *Latin America, Computer models, Computers, Computer programs.

A series of projects to establish masterplans for hydropower planning in five Latin American countries has led to the development of a standardized planning method, which could be applied to other countries with unexploited hydro potential. Computer models were developed covering hydrology, water resources engineering, hydropower design, system planning, and demand forecasting. This article focuses on the hardwater and software used, and discusses the results of the studies. (Author's abstract)
W88-02699

APPROPRIATE METHODS OF TREATING WATER AND WASTEWATER IN DEVELOPING COUNTRIES.
For primary bibliographic entry see Field 5D.
W88-02732

PROBLEM, INTERFACE FOR DECISION AND APPROPRIATE TECHNOLOGY-SCIENCE TECHNOLOGY, TECHNOLOGY TRANSFER AND UTILIZATION,
Oklahoma Univ., Norman. School of Civil Engineering and Environmental Science.
G. W. Reid.
IN: Appropriate Methods of Treating Water and Wastewater in Developing Countries. Ann Arbor Science, Ann Arbor, MI. 1982. p 1-25, 8 fig, 2 tab, 4 ref.

Descriptors: *Project planning, *Developing countries, *Water treatment, *Wastewater treatment, *Technology transfer, Decision making, Water supply development, Water management, Cost analysis, Management planning.

The Global Workshop on Appropriate Water and Wastewater Treatment Technology for Developing Countries recommended strategies for improving water and wastewater treatment for rural areas of developing countries. Involvement of the people concerned from the begining of a water supply or treatment project is important. Groundwater should by given greater attention as a source of water supply because it does not require extensive treatment. An approach is presented to assist the consulting engineer in using a systems approach and in identifying the major alternatives for project management. The engineer/client relationship is of critical importance in the process of technology transfer. Problems associated with the use of expatriate advisers in developing countries are discussed. There is a need for an improvement in communication linkages between the lesser developed countries' areas of need and sources of technology in developing countries and lesser developed countries. To shorten the time needed for development, a great deal of attention is being paid to the selection of the most effective development investments among the many choices which are possible such as expenditures for public health, malaria control, hospitals, and water resources for transportation, agriculture, industry, and education. In changing from their traditional methods, developing countries often have to use the immediately available technologies, even when they are unsuited to their economic and social conditions. The expertise of economists with overall experience in natural resource management may greatly facilitate the assessment of the actual and potential role of economic incentives in water resources development and management. (See also W88-02732) (Geiger-PTT)
W88-02733

MODEL ACCEPTANCE, LESSONS OF HISTORY AND MANAGEMENT CONCERNS,
Oklahoma Univ., Norman.
G. W. Reid.
IN: Appropriate Methods of Treating Water and Wastewater in Developing Countries. Ann Arbor Science, Ann Arbor, MI. 1982. p 325-350, 13 fig, 5 tab.

Descriptors: *Water treatment, *Wastewater treatment, *Developing countries, *Management planning, *Model studies, Public participation, Public policy, Social aspects, Economic aspects, Technology transfer.

Consumer acceptance of new water technologies often predicts the success of the modeled technology. Benefit analyses and marketing approaches may prove important in public acceptance of a proposed water project. Another approach would be the examination of successes and failures which in turn could suggest an underlying pattern. Retrospective analysis of technologies and management, together with an examination of the impacts on the societies involved, can be a valuable aid to planners. Some of the economic and management concerns with the relationship to the predictive methodology include the effect of the demand for water on model use; the costs and delays, and concepts of aggregate projects; the relationship between capital cost and operating and maintenance costs; as well as the operating and maintenance ratio. Classifications of water and sanitation technology levels and life-style levels may aid in the prediction of technology acceptance. The use of the model as it deals with sensitivity analysis should also be considered when gaging model acceptance. (See also W88-02732) (Geiger- PTT)
W88-02740

USE OF STOCHASTIC DYNAMIC PROGRAMMING FOR RESERVOIR MANAGEMENT,
California Univ., Los Angeles. Dept. of Civil Engineering.
T. Trezos, and W. W.-G. Yeh.
Water Resources Research WRERAQ, Vol. 23, No. 6, p 983-996, June 1987. 9 fig, 1 tab, 24 ref, append. NSF Grants CEE-8113500 and CEE-8301230.

Descriptors: *Reservoir operation, *Dynamic programming, *Systems analysis, *Mathematical models, *Probability distribution, *Stochastic dynamic programming, *Model studies, *Stochastic hydrology, *Reservoirs, Mathematical studies, Mathematical equations, Hydroelectric power, Decision making, Forecasting, Probabilistic process, Stochastic process.

Hydropower production plays an important role in the operation of electric energy production-distribution systems. Since most of the economically feasible hydroelectric sites have already been developed, it is necessary to examine and develop practical, real-time operational models which can be used to increase the output from existing hydropower plants. Three main issues are addressed: the potential of increasing the output from existing hydropower plants, the alleviation of dimensionality problems for multistate dynamic programming, and the use of probabilistic forecast in the decision-making process. An optimization model is developed which can be used as an analytical tool in the decision-making process for reservoir operation. The model takes into consideration the uncertainty of forecast at the time a policy must be established. The uncertainty is expressed in terms of the second moments of the forecast probability distributions. There is no limitation on the type of distribution, and it is assumed that forecast is made by a conceptual type of watershed model. The proposed methodology is applicable to constrained stochastic systems with quadratic objective functions and linear dynamics. It uses the decomposition principle of dynamic programming without discretizing the state or control variable and therefore the method can be used for large-scale systems. It is an iterative procedure which requires an initially feasible solution and solves a series of quadratic programming problems at each iteration. The applicability of the research is demonstrated through case studies. (Author's abstract)
W88-02776

STOCHASTIC MODELING OF VERTICALLY AVERAGED CONCENTRATION UNCERTAINTY IN A PERFECTLY STRATIFIED AQUIFER,
Stanford Univ., CA. Dept. of Civil Engineering.
T. C. Black, and D. L. Freyberg.
Water Resources Research WRERAQ, Vol. 23, No. 6, p 997-1004, June 1987. 10 fig, 1 tab, 26 ref. NSF Grant ECE 84-51565.

Descriptors: *Probability distribution, *Aquifers, *Model studies, *Path of pollutants, *Stochastic hydrology, *Stochastic process, *Stochastic models, *Mathematical models, *Solute transport, Solutes, Groundwater, Permeability coefficient, Probabilistic process, Monte Carlo method, Prediction.

Solute concentration which results from transport in an aquifer with unknown variability in hydraulic conductivity can be subject to large predictive uncertainty. This uncertainty can be modeled using a stochastic approach in which conductivity is represented by a random field with known probabilistic structure. The Monte Carlo methods of stochastic modeling were used to study the uncertainty in vertically flux-averaged concentration for transport in the simplified case of a perfectly stratified aquifer. A steady flow parallel to bedding and negligible transverse dispersion were assumed. Uncertainty was measured with the ensemble coefficient of variation of concentration and found to be large in most conditions examined. The validity of an ergodic assumption (practical equivalence of ensemble mean and single-realization concentrations) was investigated by considering the dependence of uncertainty upon the vertical averaging length. Even for averaging over a depth of 100 times the vertical correlation scale of conductivity, uncertainty is large enough (around 20%) to be considered significant in many predictive situations. It was concluded that prediction based solely on the ensemble mean concentration would be inappropriate for this simple system and the importance of the ensemble variance for quantification of predictive uncertainty in stochastic modeling of solute transport was emphasized. (Author's abstract)
W88-02777

WATER RESOURCES PLANNING USING INTEGRATED SYSTEMS OF MARKETABLE WATER RIGHTS AND RESERVOIR DESIGN AND OPERATION,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
B. D. C. Wong, and J. W. Eheart.
Available from the National Technical Information

Service, Springfield, VA 22161, as PB87-149308/AS. Price codes: A04 in paper copy, A01 in microfiche. Illinois Water Resources Center, Urbana-Champaign, Research Report 193, UILU-WRC-85-193. December 1985. 59 p, 11 fig, 1 tab, 74 ref. Contract No. 14-08-001-G904; 14-08-001-G1015. Project No. USGS G84007.

Descriptors: *Reservoir management, *Reservoir operation, *Water resources planning, *Planning, *Water allocation, Water storage, Water rights.

The needs and the approaches for developing (1) efficient methods for the allocation of water resources and (2) efficient planning tools for the design and operation of storage facilities and other water supply enhancement techniques, are often interrelated, and should be addressed in a coordinated fashion. Recent studies have shown that the marketable water permits system holds some attractive features as a vehicle for allocating water supplies. In this study, management techniques to integrate marketable water rights systems with systems for the design and operation of a single reservoir are developed. Three kinds of rights may be found in such integrated systems. They are natural flowing water rights, release rights, and storage rights, which are contingent on possession of permits. Auctions of these rights or other market transactions may be helpful to the design and operation of the reservoir by providing useful information about the users' demand and benefit functions. In order to assess the efficiency of these policies, their operations are simulated using economic data based on corn irrigation. These programs are then compared to some other methods of water allocation and reservoir operation. Results of the study show that high efficiency may be attained by these integrated systems. As in many other water resources and reservoir management systems, the efficiencies attained are, in part, dependent on how well the future is predicted. A highly sophisticated storage management policy is likely to generate higher efficiency than simple ones, but only if the release decisions are carefully determined. Restrictions on spot trading would also prevent some of the efficiency from being captured. When the integrated system is operated and managed by a profit-seeking private enterprise, some degree of supervision from the authority may be required to prevent the problem of supply curtailment (i.e., undersizing of the reservoir), caused by a potentially larger profit at a smaller reservoir size. (USGS)
W88-03191

CONSIDERATIONS IN SELECTING A TRANSPORTABLE THERMAL DESTRUCTION UNIT (TTDU),
Illinois State Environmental Protection Agency, Springfield.
For primary bibliographic entry see Field 5E.
W88-03236

COMMUNITY PLANNING FOR SMALL-QUANTITY HAZARDOUS WASTE GENERATORS,
Boston Univ., MA. Dept. of Urban Affairs and Planning.
For primary bibliographic entry see Field 5E.
W88-03288

6B. Evaluation Process

PREDICTION METHODOLOGY FOR SUITABLE WATER AND WASTEWATER PROCESSES,
Oklahoma Univ., Norman.
For primary bibliographic entry see Field 5D.
W88-02734

PRIORITY SETTING FOR THE RURAL WATER SUPPLY PROGRAM IN INDONESIA,
Institute of Technology Bandung (Indonesia).
S. Soetiman.
IN: Appropriate Methods of Treating Water and Wastewater in Developing Countries. Ann Arbor Science, Ann Arbor, MI. 1982. p 103-146, 3 fig, 22 tab, 12 ref.

Descriptors: *Water supply development, *Developing countries, *Indonesia, *Models studies, *Rural areas, Project planning, Public health, Waste disposal, Water demand, Economic aspects, Literature review.

A model was developed for the Indonesian Rural Water Supply Program to aid in selecting which villages should receive a water supply system first. The governmental hierarchy of Indonesia, public health, and the water supply and waste disposal situation are reviewed as background data for model development. The three main constraints in implementing the Indonesian rural Water Supply Program are money, time and manpower. A literature review is presented of the village need, village potential and system costs, economics and policy, criteria adopted by countries for assigning priorities, and priority models. The priority models presented are not suitable for the Indonesian Rural Water Supply Program at the present time because of different strategies, rural conditions and characteristics, and the lack of well-trained engineering personnel, especially at the Kabupaten levels where the selection of the project localities is made. A matrix system priority model was developed which consisted of ten elements: waterborne diseases, difficulty in obtaining water, technological alternatives, population, village contribution, village potential, public places, excreta disposal, road conditions, and power supply. The Delphi method is used as the weighting process for the ten parameters. Data for the model was obtained from the Directorate of Hygiene and Sanitation, Directorate General of Communicable Diseases, Ministry of Health, Jakarta, Indoneasia, through a survey which covered about 21,000 villages. The model was tested on six Kecamatans from four Kabupatens. Priority indices were determined to indicate which villages should receive the safe water system first. Future surveys should be conducted by well-trained sanitarians and assistant sanitarians to ensure reliability of the data. (See also W88-02732) (Geiger-PTT)
W88-02735

IN VIVO AND IN VITRO ABSORPTION AND BINDING TO POWDERED STRATUM CORNEUM AS METHODS TO EVALUATE SKIN ABSORPTION OF ENVIRONMENTAL CHEMICAL CONTAMINANTS FROM GROUND AND SURFACE WATER,
California Univ., San Francisco. School of Medicine.
For primary bibliographic entry see Field 5B.
W88-02795

DEMAND FOR URBAN WATER BY CUSTOMER CLASS,
Northern Illinois Univ., De Kalb.
For primary bibliographic entry see Field 6D.
W88-02801

EARLY-SEASON SNOW AND SKIER VISITS IN COLORADO,
Colorado Dept. of Natural Resources, Denver.
For primary bibliographic entry see Field 3B.
W88-02932

INFORMATIONAL/EDUCATIONAL APPROACHES TO PUBLIC ATTITUDES ON POTABLE REUSE OF WASTEWATER; RESEARCH STUDY REPORT; PROGRAM GUIDE FOR MUNICIPAL WATER SYSTEM ADMINISTRATORS,
Denver Research Inst., CO.
For primary bibliographic entry see Field 5D.
W88-03168

IMPACT OF RECREATION ACTIVITY SPECIALIZATION ON MANAGEMENT AND PROGRAM SUPPORT FOR WATER RESOURCES,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 6D.
W88-03173

GUIDELINES FOR DEVELOPING AREA-OF-ORIGIN COMPENSATION,
Colorado Water Resources Research Inst., Fort Collins.
L. J. Mac Donnell, C. W. Howe, J. N. Corbridge, and W. A. Ahrens.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-198116/AS. Price codes: A05 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Fort Collins, Completion Report, No. 139. December 1985. 63 p, 116 ref.

Descriptors: *Water allocation, *Water transfer, *Colorado River, *Colorado, Economic evaluation, Legal aspects, Economics, Water law.

The compensatory storage principle, established in a 1933 agreement between east and west slope interests involved in planning the Colorado-Big Thompson Project, was incorporated into the 1937 Congressional authorization for the construction of the project. In the same year the Colorado Assembly adopted the principle as mandatory for all conservancy districts. Many have since advocated compensatory storage for all out-of-basin water transfers. The Colorado law emerged from negotiations in which low-cost federal funding for east slope projects in effect was traded for compensating storage of equal volume in the Colorado River Basin. A 1973 report by the National Water Commission noted this approach may cause 'economic waste because the area of origin may not be prepared to use the compensatory storage for many years.' With major federal financing for water storage no longer available, it is time to reevaluate the compensatory storage concept. The approaches that several Western States have taken to accommodate the interests of the area-of-origin were analyzed, considering the general legal context established by the prior appropriation doctrine, the conceptual basis underlying area-of-origin compensation, and the types of legal protection that exist. Legal and economic researchers at the University of Colorado found Colorado's current approach to area-of-origin compensation has three features: (1) it protects only the Colorado River Basin--and only for out-of-basin diversions by conservancy districts; (2) it provides prospective protection only to consumptive water uses in the basin-of-origin, neglecting recreational and other instream values; and (3) it requires that costs for consumptive uses not be increased for future users in the basin-of-origin. The report contains detailed analyses and discussion of both the legal and economic issues of equitable compensation to an area-of-origin and includes general guidelines supported by study conclusions. (USGS)
W88-03192

HYDROPOWER IN INDIA - AN ECONOMIC CASE STUDY,
Minor Irrigation Dept., Lucknow (India).
For primary bibliographic entry see Field 8C.
W88-03204

COASTAL EROSION AND SEA LEVEL RISE: IMPLICATIONS FOR OCEAN BEACH AND SAN FRANCISCO'S WESTSIDE TRANSPORT PROJECT,
Harvard Univ., Cambridge, MA. Dept. of Economics.
For primary bibliographic entry see Field 2J.
W88-03294

LAND ACQUISITION CRITERIA FOR THE SUWANNEE RIVER ESTUARY, FLORIDA,
C. J. Leadon, and O. F. Wetterqvist.
Coastal Zone Management Journal CZMJBF, Vol. 14, No. 3, p 217-239, 1986. 6 fig, 24 ref.

Descriptors: *Evaluation, *Land acquisition, *Suwannee River Estuary, *Planning, *Resources management, Water management, Resources allocation, Florida, Natural resources, Land use, Wetlands.

Land acquisition criteria for evaluating lands important to nonstructural water management were

formulated for Florida's Save Our Rivers program. Parcels of land are rated according to scientific aspects of primary importance within hydrology, water quality, ecology, and endangerment categories in this system. The regional importance and future resource value of land are emphasized in these practical criteria. The system's scoring range is described by the application of the criteria to the wetlands of the Suwannee River Estuary and three hypothetical tracts in northern Florida. The Suwannee River Estuary's wetlands, on Florida's Big Bend Gulf coast, were designated the site of the Lower Suwannee National Wildlife Refuge. The application of the criteria system to the Suwannee River Estuary's wetlands resulted in the 1983 purchase of 9220 acres by the Suwannee River Management District. (Author's abstract)
W88-03295

FEDERAL-STATE COOPERATIVE PROGRAM IN KANSAS, SEMINAR PROCEEDINGS, JULY 1985,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 6E.
W88-03413

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

IMPACT OF LEGISLATION ON ELECTRIC UTILITIES,
Tennessee Valley Authority, Chattanooga. Div. of Energy Demonstrations and Technology.
For primary bibliographic entry see Field 5G.
W88-02653

COST OF CONTROL - WHO WILL PAY,
Environmental Management Associates, Princeton, NJ.
For primary bibliographic entry see Field 5G.
W88-02655

COST STRUCTURE OF THE WATER UTILITY INDUSTRY,
Southern Methodist Univ., Dallas, TX.
K. Hayes.
Applied Economics APPEBP, Vol. 19, No. 3, p 417-425, March 1987. 7 tab, 15 ref.

Descriptors: *Costs, *Economic aspects, *Cost structure, *Water utility industry, *Model studies, Mathematical equations, Retail water, Wholesale water, Cost analysis, Total costs, Capital costs, Operating costs.

Water is produced for retail and wholesale markets; retail water is sold for direct consumption while wholesale water is sold to another water utility to be subsequently resold as retail output. The cost structure of a joint product water utility producing both retail and wholesale water was studied. The total cost of services for both retail and wholesale, included operation and maintenance costs as well as capital costs. Several empirical tests were conducted to determine whether sufficient cost complementarity exists to justify joint resale and wholesale production. Results indicated that regulatory policy should allow, and even encourage, the continuation of joint retail and wholesale production especially for small firms. Cost savings drop dramatically for larger firms. The largest firms are characterized by diseconomies of scope. The degree of economies tended to fall over time for the largest firms and tended to increase for smaller firms. (Wood-PTT)
W88-02802

REDUCING WATER PUMPING POWER COSTS,
Waxahachie Utilities Dept., TX.
For primary bibliographic entry see Field 8C.
W88-02812

SIMULATION OF THE COSTS OF REMOVING SNOW FROM COUNTY HIGHWAYS IN COLORADO,
Colorado Dept. of Natural Resources, Denver.
L. A. Sherretz, and W. Loehr.
March 1983. Bureau of Reclamation, Denver, CO. 39 p, 6 fig, 15 tab, 20 ref, append.

Descriptors: *Weather modification, *Snow removal, *Cost analysis, *Cloud seeding, *Colorado, Environmental effects, Mountains, Snowfall, Model studies.

A simulation model was used to assess procedures and estimate costs of removing snow from country highways in mountainous areas of Colorado. Many citizens and local officials had expressed concern about the effect of cloud seeding on snow removal costs. In a hypothetical cloud seeding season, it was estimated that one-third of the storms would have 25% greater snowfall or a seasonal increase of 4.5-9.7%. For natural storms estimated costs per employee of removing snow ranged from $1300 in Eagle County in a winter of average snowfall to more than $11,000 in San Juan County in a winter of high snowfall. Exceptions were in winters with many small storms; it was more expensive per inch to remove small amounts of snow than large amounts. For natural storms costs of snow removal in low-snowfall winters were 81% of costs of average snowfall winters; costs in high-snowfall winters were 141% of costs in average snowfall winters. Estimated costs for removing snow augmented by cloud seeding ranged from a 0.8% increase in Garfield County in a low-snowfall winter to 12.6% in Lake County in a high-snowfall winter. Average cost increases for all counties were 6.1% in winters with high and average snowfall and 4.9% in winters of low snowfall. (Cassar-PTT)
W88-02929

COST-EFFECTIVENESS OF THE U.S. GEOLOGICAL SURVEY'S STREAM-GAGING PROGRAMS IN MASSACHUSETTS AND RHODE ISLAND,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03059

COST EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03061

ECONOMIC VALUE OF WETLANDS SYSTEMS,
Louisiana State Univ., Baton Rouge. Dept. of Economics.
For primary bibliographic entry see Field 2H.
W88-03214

COST EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03320

COST EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03342

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN THE HAWAII DISTRICT,
Geological Survey, Honolulu, HI. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03445

INSTITUTIONAL ARRANGEMENTS AND FINANCING ALTERNATIVES FOR STATE AND LOCAL WATER PROGRAMS,
Arkansas Univ., Fayetteville. Dept. of Economics.
J. A. Ziegler.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-151719/AS. Price codes: A04 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville. Pub. No. 115, September 1985. 64 p, 4 tab. Contract No. 14-08-0001-G893. Project No. USGS G893-06.

Descriptors: *Arkansas, *Water resources development, *Financing, *Water costs, Bond issues, Economic efficiency.

This study analyzes the alternative institutional arrangements and financing alternatives for water projects at the state and local levels with particular emphasis on Arkansas. Because most water projects are financed with debt it concentrates on alternatives which can reduce the cost of debt and/or result in more efficient use of existing facilities. Specific state options considered include grants, loans, revolving funds, debt guarantee, bond insurance, bond bank, statutory and regulatory reform of water laws and water-related institutions, and planning and technical assistance. Specific local options include use of taxes and bonds including creative financing, user fees, leasing, privitization, and financial planning. (Ziegler-WRRC-University of Arkansas, Fayetteville)
W88-03488

6D. Water Demand

PRIORITY SETTING FOR THE RURAL WATER SUPPLY PROGRAM IN INDONESIA,
Institute of Technology Bandung (Indonesia).
For primary bibliographic entry see Field 6B.
W88-02735

WATER SUPPLIES IN RURAL AREAS OF DEVELOPING COUNTRIES,
Technische Hogeschool Delft (Netherlands).
L. Huisman, N. Van Gorkum, and K. Kempenaar.
IN: Appropriate Methods of Treating Water and Wastewater in Developing Countries. Ann Arbor Science, Ann Arbor, MI. 1982. p 147-185, 22 fig, 1 tab.

Descriptors: *Water supply development, *Water treatment, *Developing countries, *Rural areas, *Water supply, Disinfection, Filtration, Sedimentation, Coagulation, Project planning, Cisterns, Flocculation, Artificial recharge, Consumptive use.

Many obstacles stand in the way of improvements to water supply and treatment systems in rural areas of developing countries. Lack of public education about water related diseases and shortage of maintenance personnel often cause failure of remedial projects. To provide a region with a public water supply, a master plan is necessary, followed by detailed feasiblity studies on technical, financial, organizational, and managerial aspects. Methods for calculating average daily consumptive needs are given. The quality and quantity of water available from rainwater, groundwater, springwater, surface water, and artificial recharge are discussed. Groundwater sources are the most favorable in terms of bacteriological quality but these may contain traces of iron that affect taste. Several water treatment methods are examined (aeration, plain sedimentation, chemical coagulation, flocculation and settling, slow sand filtration, rapid filtration, activated carbon filtration, and disinfection) and diagrams of indigenous technology are provided. Financing of water supply projects is often difficult in developing countries. Data on raw water sources and water quality should be collected for project planning. Systems for rainwater catchment, storage, and evaporation control are examined. Disinfection is usually accomplished by chlorination in pot cartridges. A new trend in the coagulation process is the magnesium carbonate process. Drum filters or sand filters give good results in small village or individual supplies. Demineralization including desalting may be accomplished in rural sunny areas through a kind of distillation by a solar still. (See also W88-02732) (Geiger-PTT)
W88-02736

MODEL TO PREDICT WATER DEMAND, WASTEWATER DISPOSAL, COST OF TREATMENT SYSTEMS, AND EQUIPMENT REQUIRED,
Oklahoma Univ., Norman.
For primary bibliographic entry see Field 5D.
W88-02739

PHOENIX DROWNING IN THE ARIZONA DESERT,
F. Pearce.
New Scientist NWSCAL, Vol. 114, No. 1562, p 52-53,55-56, May 1987.

Descriptors: *Water allocation, *Water control, *Water demand, *Water conveyance, *Water distribution, *Water use, *Arizona, *Western USA, Water resources institutes, Water scarcity, Conveyance structures, Water costs, Water management, Water supply, Colorado River, Irrigation water, Economic aspects, Available water.

In order to keep the sunbelt cities of Arizona supplied with water, the federal government's Bureau of Reclamation is building one of the world's largest and most expensive water supply systems. The Central Arizona Project, when complete, will remove up to 1.9 cu km of water per year from the Colorado River and transport it by aqueduct across 500 km of desert to Phoenix and Tucson. Since 1902 the Bureau of Reclamation has overseen the damming of rivers and digging of aqueducts to bring water to farms across 17 western states. However, there are no good dam sites left to develop and little water left to capture so new plans are not economical. It was also observed that about 45% of the land in the west irrigated by the government is supplying crops like alfalfa and cotton that are officially in surplus. The question of whether it is feasible to increase, or even maintain, water supplies to western farms for the irrigation of surplus crops is explored and the terms of the Colorado Compact of 1922 allocating the Colorado River water in the western states and conflicts between large cities and the farm areas over the available water are reviewed. (Wood-PTT)
W88-02789

EFFICIENCY IN WATER ALLOCATION UNDER STOCHASTIC DEMAND,
California Univ., Santa Barbara.
J. K. Sengupta, and M. Khalili.
Applied Economics APPEBP, Vol. 18, No. 1, p 37-48, January 1987. 5 tab, 9 ref.

Descriptors: *Water allocation, *Water use efficiency, *Water demand, *Agronomy, *Model studies, *Data interpretation, *Economic aspects, Agriculture, Crop production, Comparison studies, Evaluation, Mathematical equations, Water use, Santa Maria Valley, Risks, Prices, Elasticity of demand, Elasticity of supply, Economic efficiency.

Efficiency in water allocation for agricultural uses is evaluated through quadratic programming (QP) models, which explicitly incorporate risk aversion due to yield and price fluctuations and endogenous demand functions econometrically estimated. These models, when empirically applied to Santa Maria Valley in Santa Barbara County over the period 1959-80 generate optimal solutions, through which the shadow price elasticity of demand and the impact of prices on optimum supply can be evaluated. These evaluations show the QP model solutions to be more robust and reliable than the linear programming solutions; hence, their shadow prices may be used in securing efficiency in the allocation of agricultural water. (Author's abstract)
W88-02800

DEMAND FOR URBAN WATER BY CUSTOMER CLASS,
Northern Illinois Univ., De Kalb.
M. Williams, and B. Suh.
Applied Economics APPEBP, Vol. 18, No. 12, p 1275-1289, December 1986. 4 tab, 25 ref. NSF Grant SES 8310583.

Descriptors: *Water demand, *Urban water demand, *Model studies, *Economic aspects, Data interpretation, Comparison studies, Mathematical equations, Industrial water, Municipal water, Commercial water, Evaluation, Residential water, Elasticity of demand, Pricing, Prices, Water rates.

The factors which determine the demand for water for different classes of users including residential, commercial and industrial, were determined and the sensitivity of demand to price changes for each of these classes was ascertained. The effects of selecting any given price measure on the statistical properties of the estimated demand function were examined especially with regard to misspecification bias. The models of demand by customer class and the empirical results and specification error tests for each model are presented. Demand is relatively price inelastic for residential and commercial water consumption, irrespective of which price measure is selected. Industrial demand is relatively more sensitive to price variations than residential and commercial demand which suggested that any pricing policy implemented to allocate urban water among competing users is most likely to be effective if applied to industrial users since it is reasonable to expect industrial consumers to adjust to a significant price increase by recycling water in the production processes. The results of the specification error test on the fifteen demand equations indicates that for this sample, use of marginal price is generally more appropriate for the estimation of price elasticities of demand. (Wood-PTT)
W88-02801

GROUND WATER AND ENERGY: REPORT OF THE U.S. DEPARTMENT OF ENERGY'S NATIONAL WORKSHOP, JANUARY 29-31, 1980, ALBUQUERQUE, NEW MEXICO.
Department of Energy, Washington, DC. Div. of Environmental Impacts.
CONF-800137-Summary, May 1980. 2 fig, 2 append. Contact No. 4-L20-8108N-1.

Descriptors: *Planning, *Water supply, *Water management, *Groundwater management, *Water policy, *Energy, Water law, Environmental effects, Saline water, Mine drainage, Model studies, Deep wells, Legal aspects, Water rights, Aquifers, Economic aspects, Water use, Decision making, Political constraints.

The National Workshop on Ground Water and Energy Production concentrated on three main areas: groundwater supply, conflicts and barriers to its use, and alternatives or solutions to various issues. The following key findings are summarized in this report. Although water supplies are generally adequate for energy needs, local shortages exist. Data bases and modeling tools are generally well developed at the regional level, but data are often deficient at the local level. Use of groundwater for energy production entails the possibility of environmental degradation; more information is available on cost of control measures than on the benefits of mitigation. Use of less desireable waters--saline water, deep groundwater, and mine water--offers an alternative source of supply, but economic and potential contamination problems exist. Decision making, analysis, and management are complicated by legal rules which are constantly changing and which vary greatly among jurisdictions. Likewise, lack of uniform practices, goals, policies, and interests cause problems in management of groundwater resources. Bidding for water supplies is hard to administer fairly because energy companies usually have many more financial resources than irrigators or other users. The Department of Energy needs to chart and publicize its policies that affect water. (Cassar-PTT)
W88-02948

ANNUAL GROUND-WATER USE IN THE TWIN CITIES METROPOLITAN AREA, MINNESOTA, 1970-79,
Geological Survey, St. Paul, MN. Water Resources Div.
M. A. Horn.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Data Report 84-577, 1984. 130 p, 7 fig, 14 tab, 4 ref.

Descriptors: *Water use, *Groundwater, *Minnesota, *Twin Cities Metropolitan Area, Water management, Data collections.

Annual groundwater use in the Twin Cities Metropolitan Area from 1970-79 is presented by aquifer and type of use. Most groundwater is withdrawn from wells in the Prairie du Chien-Jordan aquifer and major uses of the water are for self-supplied industry and public supplies. Annual groundwater-use data are presented by county for each of the five major aquifers; Prairie du Chien-Jordan, Mount Simon-Hinckley, Ironton-Galesville, St. Peter, and drift. The data also are presented by county for each major use type including public supply, self-supplied industry, commercial air-conditioning, irrigation, lake-level maintenance, and dewatering. The data were collected initially by the Minnesota Department of Natural Resources and were supplemented by data collected by the U.S. Geological Survey. (USGS)
W88-02958

WATER RESOURCES MANAGEMENT IN LOWNDES COUNTY, MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
A. Shindala, V. L. Zitta, W. L. McDonald, and L. W. Moore.
Mississippi Water Resources Research Institute Report D-025-MS, December 1983. 170 p, 26 fig, 38 tab, 5 ref, 3 append.

Descriptors: *Water management, *Mississippi, *Lowndes County, *Comprehensive planning, *Water supply, *Potential water supply, *Regional planning, Surface-groundwater relations, Groundwater, Cost analysis, Water conservation, Surface water availability, Aquifers, Computer models, Model studies, Management planning, Water use.

This report presents the results of a one-year investigation to develop a comprehensive county-wide water resources management plan. Lowndes County can be classified as a 'Water Surplus Area.' Groundwater resources are adequate to continue to supply all projected municipal water demands. However, due to the huge volume of projected industrial water needs, conjunctive use of ground and surface waters is recommended as the ultimate solution to meet the future industrial demand. The major portion of this demand should be drawn from surface supplies. A regional county-wide water system is not feasible for Lowndes County partly due to the abundance of groundwater adjacent to existing demand centers and because of the physical locations of these centers. However, a regional system may be feasible for Columbus and east Lowndes Water Association due to the proximity of the service areas of the two demand centers. A regional system will provide advantages such as economy of scale, improved operation efficiency, and increased system reliability. The investigation evaluated current and projected water use along with the potential of surface and groundwater resources in meeting the projected water demand. A two-dimensional groundwater model was used in exploring the potential of the groundwater resources. The primary water users in Lowndes County are public utilities and self-supplied industries. Total current and projected demand for public consumption was estimated at 4.87 million gallons/day and 7.21 million gallons/day, respectively. (Fazio-Omniplan)
W88-02961

WATER RESOURCES MANAGEMENT IN ALCORN COUNTY, MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
A. Shindala, V. L. Zitta, M. W. Corey, and L. Moore.
Mississippi Water Resources Research Institute Report D-024-MS, January 1984. 151 p, 23 fig, 37 tab, 26 ref, 3 append.

Descriptors: *Water management, *Mississippi, *Comprehensive planning, *Groundwater, *Potential water supply, *Water use, Regional planning, Water supply, Pumping, Water level, Pumpage,

Cost analysis, Aquifers, Aquifer characteristics, Water conservation, Surface water, Alcorn County,.

This report presents the results of a one-year investigation to develop a comprehensive county-wide water resources management plan. Water supply for public, industrial, domestic, and agricultural use in Alcorn County comes exclusively from groundwater. Paleozoic rocks and the Coffee Sand are the primary groundwater resources. Total current and projected water use, year 2010, are estimated at 4.8 million gallons/day and 11.1 million gallons/day, respectively. The city of Corinth is the county's largest water user with use estimated at 66.7% and 81.1% of total current and projected water use in Alcorn County. Corinth obtains its entire water supply from the Paleozoic aquifer. The static water level above the Paleozoic has been steadily and rapidly declining in the Corinth area. However, reduced water consumption by the city and a change in the pumping pattern has resulted in recovery (28.4 ft) in the water level during 1974-1982. Corinth could continue to use the Paleozoic as its major source of water supply (5 million gallons/day) if the well field or pumpage were distributed around the area rather than concentrated in a small section of town. Future needs must be supplemented from either the coffee Sand aquifer or an impoundment on the Tuscumbia River; however, water removed from the Coffee Sand will require treatment for iron removal. All other communities in the area could continue to use the Paleozoic as the sole source of water provided that pumpage by Corinth be at a reasonable rate and distributed rather than concentrated in a small area. (Fazio-Omniplan)
W88-02962

WATER USE IN ARKANSAS, 1981,
Geological Survey, Little Rock, AR. Water Resources Div.
A. P. Hall, and T. W. Holland.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 84-4070, 1984. 1 p, 8 fig, 3 ref, map.

Descriptors: *Water use, *Consumptive use, *Groundwater, *Surface water, *Arkansas, Withdrawal, Water supply, Municipal use, Domestic water, Industrial water, Irrigation water, Fish farming, Electric power production, Coastal plain.

Water use and consumption data for 1981 are presented by county and source. Use-data are presented by category for each county. Total water use, excluding wildlife impoundments, was 32,970 million gallons per day, which was 19 percent less than in 1980; consumption was 4,610 million gallons per day. Ground water use was 4,270 million gallons per day, and suface-water use was 2,870 million gallons per day. Use in million gallons per day, by categories, was as follows: public supply, 247 (down 6 percent from 1980); self-supplied industry, 237 (up 1 percent); rural domestic and livestock, 120 (up 2 percent); irrigation, 4,370 (up 7 percent); fish farming, 353 (down 1 percent); electric energy generation, 27,640 (down 22 percent). Of the total water use for electric energy generation, 17.4 million gallons per day of surface water was used for hydroelectric energy generation, down about 33 percent from 1980 estimated usage. (USGS)
W88-02982

EVALUATION OF TECHNIQUES FOR MAPPING LAND AND CROPS IRRIGATED BY CENTER PIVOTS FROM COMPUTER-ENHANCED LANDSAT IMAGERY IN PART OF THE JAMES RIVER BASIN NEAR HURON, SOUTH DAKOTA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03014

TRENDS IN MUNICIPAL-WELL INSTALLATIONS AND AQUIFER UTILIZATION IN SOUTHEASTERN MINNESOTA, 1880-1980,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 4B.
W88-03042

PERMITTED WATER USE IN IOWA, 1985,
Geological Survey, Iowa City, IA. Water Resources Div.
D. L. Runkle, J. L. Newman, and E. M. Shields.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-302, 1986. 24 p, 31 fig, 2 tab, 4 ref.

Descriptors: *Water use, *Permit, *Iowa, Surface-water, Groundwater, Mining, Irrigation, Self-supplied industrial, Non-irrigation agriculture, Power generation, Public water supplier, Self-supplied commercial.

This report summarizes where, how much, and for what purpose water is used in Iowa with permits issued by the Iowa Department of Water, Air, and Waste Management. In Iowa, 58 percent of the total 855,175.4 million gallons per year is from surface-water sources and 42 percent is from groundwater sources. Power generators are permitted the largest percentage of total water use. The public water suppliers category is the next largest use type of the total permitted water. Mining comprises 13.4 percent of the total water use and is the third largest water-use category. Irrigation is the fourth highest permitted use type comprising 12 percent of the total water use. Self-supplied industrial users are permitted 10.6 percent of the total permitted water use. Self-supplied commercial use is allocated 1.5 percent of the total permitted water. Non-irrigation agricultural use is 0.1 percent of the total permitted water. The areas that are allocated the most water permits are east-central Iowa and west-central Iowa. (USGS)
W88-03078

USE AND AVAILABILITY OF CONTINUOUS STREAMFLOW RECORDS IN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03079

GROUNDWATER CONDITIONS IN UTAH, SPRING OF 1985,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03098

BASINWIDE INSTREAM FLOW ASSESSMENT MODEL TO EVALUATE INSTREAM FLOW NEEDS,
Illinois State Water Survey Div., Champaign.
For primary bibliographic entry see Field 2E.
W88-03164

IMPACT OF RECREATION ACTIVITY SPECIALIZATION ON MANAGEMENT AND PROGRAM SUPPORT FOR WATER RESOURCES,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
J. T. O'Leary, and J. C. Behrens-Tepper.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-167707/AS. Price codes: A04 in paper copy, A01 in microfiche. Technical Report No. 172. September 1985. 50 p, 12 tab, 52 ref. Contract No. 14-08-0001-G905. Project No. USGS G905-05.

Descriptors: *Fishing, *Indiana, Recreation, Recreation demand, Surveys, Attitudes.

Recreation specialization is a term that refers to disaggregating participants within specific outdoor recreation activities into more homogeneous subgroups. This conceptual framework has been applied to Indiana freshwater anglers as high visibility users of the state's water resource. The angler sample examined consists of 535 Indiana residents who responded to the 1980 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. The present study classified anglers into three ordinal specialization categories based on annual frequency of participation in four different types of freshwater fishing. Results indicate that level of specialization is related to concentration on a particular freshwater type. Urban anglers are proportionately represented in each specialization level. Approximately 40 percent of Indiana freshwater anglers fish most in manmade lakes and reservoirs greater than 10 acres; 13 percent fish most in rivers and streams. Little support is found for the hypothesis that conservation organization support varies predictably with level of specialization. Age at initial exposure to fishing and years of fishing experience both are found to differentiate among those freshwater anglers exhibiting low, medium, and high levels of participation. The distribution of age at initial exposure to fishing indicates that over 95 percent of Indiana's freshwater anglers are involved by age 20. The importance of an early introduction to fishing for continued participation as an adult suggests that agencies consider providing future anglers with early learning opportunities. (Cushman-Water Resources Res. Cr., Purdue U.)
W88-03173

ECONOMIC VALUE OF WETLANDS SYSTEMS,
Louisiana State Univ., Baton Rouge. Dept. of Economics.
For primary bibliographic entry see Field 2H.
W88-03214

SUMMARY OF MUNICIPAL PUMPAGE FOR THE FRESNO AREA, CALIFORNIA, 1931-80,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W88-03393

INVENTORY OF INTERBASIN TRANSFERS OF WATER IN THE WESTERN CONTERMINOUS UNITED STATES,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 4A.
W88-03394

OPTIMAL ALLOCATION AND SCHEDULING OF IRRIGATION WATER FOR COTTON AND SOYBEANS,
Arkansas Univ., Fayetteville. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 3F.
W88-03490

6E. Water Law and Institutions

LONDON DUMPING CONVENTION AND ITS ROLE IN REGULATING DREDGED MATERIAL: AN UPDATE,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
R. M. Engler.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 233-244, 11 ref.

Descriptors: *London Dumping Convention, *Regulations, *Dredging, *Waste disposal, Sediments, Waste management, Water quality control.

The Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter--known as the London Dumping Convention or LDC--was formed in 1972 and came into force in the United States in 1975. The policy, regulatory, and technical aspects of the Corps of Engineers' ocean dumping program for dredged material are directly affected by the United States being signatory to the LDC. The contracting nations have met annually since LDC-1 met in September 1976. Since that time, an extensive program of work was adopted related to the implementation of the Convention concerning all aspects of dumping at sea. Requirements of the LDC are discussed in relation

ot the United States' domestic ocean dumping regulations. Emphasis is placed on application of the technical Annexes to the Convention. An update of the LDC annual meetings includes LDC-8 and LDC-9--which met in February 1984 and September 1985, respectively. Future strategy at the Convention emphasized the need for a multidisposal media approach at waste management that places ocean disposal on an equal basis with land based alternatives in the early planning phase of a project. (See also W88-02513) (Author's abstract)
W88-02529

REGULATION OF THE DISPOSAL OF DREDGED MATERIAL IN FLORIDA,
Florida State Dept. of Environmental Regulation, Tallahassee.
For primary bibliographic entry see Field 5E.
W88-02564

SELECTED VARIABLES AFFECTING THE CHOICE BETWEEN FEDERAL AND STATE REGULATORY RESPONSIBILITY: GROUNDWATER QUALITY AS AN ILLUSTRATIVE CASE,
Utah State Univ., Logan.
D. B. Goetze.
Groundwater Contamination, National Academy Press, Washington, DC. February 1984. p 159-165, 25 ref.

Descriptors: *Groundwater management, *Groundwater pollution, *Water quality management, *Water law, *Decision making, Water quality control, Cost analysis, Economic aspects, Regulations, Legal aspects, Jurisdiction.

It is hypothesized that jurisdictional scope and the structural location of decision makers will affect the relative efficiency of federal and state governments in regulating groundwater quality. Arguments are presented that suggest that the jurisdictional scope of state governments is more conducive to regulatory efficiency than the larger scope of the federal government when the scope of problem effects is confined to state boundaries. When problem effects substantially exceed state boundaries the suggestion is that federal regulation is more efficient, other things being equal. Since the scope of effects of most interstate aquifers probably exceeds state boundaries, an efficiency advantage is attributed to federal regulation. The closer structural distance of state decision makers to problem conditions and preference information may give them an efficiency advantage over federal decision makers when information needed for regulatory decisions is considered. Other variables that affect regulatory efficiency should be taken into account. Differences in political pressures at federal and state levels, and in resources, legislation, and the regulatory decision rules are all likely to affect the relative efficiency of federal and state regulation. (See also W88-02602) (Geiger-PTT)
W88-02615

RISK ASSESSMENT FOR THE PREVENTION OF GROUNDWATER CONTAMINATION,
Case Western Reserve Univ., Cleveland, OH.
For primary bibliographic entry see Field 2F.
W88-02616

CURRENT LEGISLATIVE DIRECTIONS,
Wald, Harkrader and Ross, Washington, DC.
For primary bibliographic entry see Field 5G.
W88-02652

IMPACT OF LEGISLATION ON ELECTRIC UTILITIES,
Tennessee Valley Authority, Chattanooga. Div. of Energy Demonstrations and Technology.
For primary bibliographic entry see Field 5G.
W88-02653

IMPACT OF 'MOST LIKELY' LEGISLATION ON INDUSTRY,
Kaiser Aluminum and Chemical Corp., Columbus, OH. Midwest Region.
For primary bibliographic entry see Field 5G.
W88-02654

HAZARDOUS WASTE MANAGEMENT, VOLUME I: THE LAW OF TOXICS AND TOXIC SUBSTANCES.
For primary bibliographic entry see Field 5E.
W88-02754

HAZARDOUS WASTE MANAGEMENT,
Synthetic Organic Chemical Manufacturers Association, Inc., Washington, DC.
For primary bibliographic entry see Field 5E.
W88-02755

CONSTITUTIONAL FRAMEWORK OF HAZARDOUS WASTE LEGISLATION,
K. G. Bartlett.
IN: Hazardous Waste Management, Volume I: The Law of Toxics and Toxic Substances. CRC Press, Inc., Boca Raton, Florida. 1986. p 11-39.

Descriptors: *Waste disposal, *Hazardous materials, *Waste management, *RCRA, *Regulations, *Water law, Toxicity, Waste dumps, Legislation, Waste recovery, Legal review.

The role of the Resource Conservation and Recovery Act of 1976 (RCRA) and the Superfund Act in the management of hazardous wastes is discussed. RCRA has attempted to close the gap of regulatory control by establishing a comprehensive manifest system that identifies hazardous wastes and maintains a generic listing of such waste. RCRA allows individual states to implement and maintain the regulatory process, pursuant to express federal standards. The Superfund Act is concerned with hazardous waste contamination from spills and abandoned dumpsites when there is no other party taking prompt action to clean up the affected areas. The owner or opertor of any vessel or facility from which a hazardous substance is discharged is strictly liable to the U. S. for the actual costs incurred by the government for the removal or clean-up of such materials. Superfund also allows for federal and state cooperation in cleaning up affected areas which have been abandoned. The constitutional framework of hazardous waste legislation is examined at the federal and state levels with a focus on due process and equal protection, and administrative review. Several cases of preemption and use of the commerce clause under the RCRA are discussed. (See also W88-02754) (Geiger-PTT)
W88-02756

REMEDIAL OPTIONS IN HAZARDOUS WASTE MANAGEMENT - AN OVERVIEW,
EWK Consultants, Inc., Washington, DC.
For primary bibliographic entry see Field 5E.
W88-02757

FROM CRADLE TO GRAVE: THE LEGISLATIVE HISTORY OF RCRA,
Davis, Graham and Stubbs, Washington, DC.
J. H. Howard.
IN: Hazardous Waste Management, Volume I: The Law of Toxics and Toxic Substances. CRC Press, Inc., Boca Raton, Florida. 1986. p 51-78.

Descriptors: *Water law, *Waste disposal, *Wastewater disposal, *Hazardous materials, *RCRA, *Solid waste disposal, Legal aspects, Coal mining, Mine wastes, Inspection, Environmental policy, Waste dumps, Public health, Waste management, Waste recovery.

The legeislative history of the Resource Conservation and Recovery Act of 1976 (RCRA) is discussed in relation to its role in hazardous waste management. It was not until 1970 that Congress began to define the type of wastes which are considered hazardous and establish a policy which was regulatory in nature. The first Bill to provide for the regulation of hazardous waste was S. 1086, the Hazardous Waste Management Act of 1973. In 1975, the second comprehensive bill to regulate hazardous waste (S. 2150) was introduced. This Bill directed EPA to establish criteria for identifying hazardous waste and guidelines for determining harmful quantities of such wastes. House Bill 14496 set the structural framework for RCRA and addressed the regulation of hazardous waste in a much more comprehensive manner than did the Senate Bill. The Solid Waste Disposal Act Amendments of 1980 introduced important additions to the RCRA in relation to coal mining wastes and overburden, gas and oil mining and overburden, distinctions between new and existing facilities, interim status, RCRA inspection authority, additional criminal penalties, new crime of knowing endangerment, new hazardous waste inventory, open dumping, and expansion of RCRA's imminent hazard authority. The 1980 amendments also deal with the degree of hazard issue. The 1984 amendments required that EPA promulgate standards for hazardous waste generated in quantities between 100 and 1000 kg/month. These amendments also deal with land disposal of hazardous materials. Several judicial interpretations of RCRA are presented, including examples of Supreme Court and Lower Court authority. (See also W88-02754) (Geiger-PTT)
W88-02758

SUMMARY AND ANALYSIS OF THE RESOURCE CONSERVATION AND RECOVERY ACT OF 1976, AS AMENDED,
Cleary, Gottlieb, Steen and Hamilton, Washington, DC.
R. C. Hinds.
IN: Hazardous Waste Management, Volume I: The Law of Toxics and Toxic Substances. CRC Press, Inc., Boca Raton, Florida. 1986. p 79-97.

Descriptors: *Water law, *Hazardous materials, *Waste disposal, *Waste management, *RCRA, *Solid waste disposal, Regulations, Permits, Legal aspects, Waste dumps, Sanitary landfills, Land disposal, Monitoring, Wastewater disposal, Waste storage, Wastewater disposal.

An overview of the Resource Conservation and Recovery act of 1976 (RCRA) as amended is given. The RCRA directs the EPA to identify which wastes are hazardous, issue standards for generators of hazardous wastes, issue standards applicable to transporters of hazardouds wastes and to owners and operators of facilities engaged in treating, storing or disposing of haardous wastes, and to issue regulations requiring all persons who treat, store, or dispose of hazardous wastes to obtain a permit to carry on such activities. RCRA also directs EPA to develop and publish guidelines for solid waste management and provide minimum criteria for the development of state solid waste management plants. The RCRA gives the Department of Commerce, EPA, and a new Interagency Coordinating Committee responsibility for conducting a variety of programs to encourage solid waste utilization and reduction. The duties of EPA, the Interagency Coordinating Committee and the Department of Commerce under the RCRA are discussed. (See also W88-02754) (Geiger-PTT)
W88-02759

HAZARDOUS WASTE MANAGEMENT PROGRAM UNDER THE RESOURCE CONSERVATION AND RECOVERY ACT.
Cleary, Gottlieb, Steen and Hamilton, Washington, DC.
IN: Hazardous Waste Management, Volume I: The Law of Toxics and Toxic Substances. CRC Press, Inc., Boca Raton, Florida. 1986. p 99-146.

Descriptors: *Waste management, *Waste disposal, *Water law, *Regulations, *RCRA, *Hazardous materials, Waste identification, Waste characteristics, Waste storage, Land disposal, Waste dumps, Wastewater treatment, Legal aspects, Permits, Landfills, Incineration.

An overview of the Hazardous Waste Program under the Resource Conservation and Recovery Act of 1976 (RCRA) is given. The identification of hazardous wastes, standards for generators and transporters, requirements for treatment, storage, and disposal facilities, and special standards are

discussed. State hazardous waste programs and civil and criminal penalties are outlined. Permitted facilities that treat, store, or dispose of hazardous waste in surface impoundments, waste piles, land treatment units, or landfills after January 26, 1983, must comply with the Part 264 groundwater protection standards. Monitoring programs must be established to make sure that hazardous constituents are not leaking into groundwater. The Part 264 regulations also establish certain design and performance standards for surface impoundments, piles, and landfills that are used to treat, store, or dispose of hazardous wastes. Each impoundment, pile, or landfill, except for portions on which wastes were placed prior to permit issuance, must have a liner that is designed to prevent any migration of wastes out of the facility during its active life. The RCRA permit program and procedures for permit decision-making are presented. (See also W88-02754) (Geiger-PTT)
W88-02760

LEGAL DEVELOPMENT OF REMEDIES FOR TOXIC TORT PLAINTIFFS - COMMON LAW REMEDIES,
Environmental Law Inst., Washington, DC.
M. J. Marvin, and K. G. Bartlett.
IN: Hazardous Waste Management, Volume I: The Law of Toxics and Toxic Substances. CRC Press, Inc., Boca Raton, Florida. 1986. p 147-172.

Descriptors: *Water law, *Waste disposal, *Legal aspects, *Liabilty, *RCRA, *Hazardous materials, Toxicity, Wastewater disposal, Waste management, Insurance, Public health.

Reports concerning personal injuries resulting from exposure to toxic substances (toxic torts) have been appearing in the news media with increasing frequency during the past several years. Mass exposure cases have arisen in four broad areas of toxic torts: worker exposure, military service-related exposure, public exposure via pharmaceuticals, and public exposure via contaminated environment. One of the first toxic pollution cases involved 350 members of 97 families who alleged that contamination of their drinking water caused both personal injury and property damage. Several methods that have recently been used to streamline the mangement of mass exposure tort litigation are discussed. The common law of toxic torts is outlined. Causes of action for negligence, strict liability, and nuisance are examined. Several recurring issues in toxic cases are the shifting of burdens and the appportioning of damages, deciding the statute of limitations, defining causation, and clarifying insurance theories. EPA regulations requiring owners and operators of toxic waste sites to carry liability insurance for bodily injury and property damage to third parties resulting from facility operations should help alleviate some of the problems caused by pollution. (See also W88-02754) (Geiger-PTT)
W88-02761

LEGAL DEVELOPMENT OF REMEDIES OF HAZARDOUS WASTE VICTIMS - STATUTORY REMEDIES,
K. G. Bartlett.
IN: Hazardous Waste Management, Volume I: The Law of Toxics and Toxic Substances. CRC Press, Inc., Boca Raton, Florida. 1986. p 173-182.

Descriptors: *Water law, *Legal aspects, *Hazardous materials, *Liability, *RCRA, *Waste disposal, Waste management, Public health, Economic aspects, Risks, Compensation.

The various types of legislative proposals which are emerging to offer statutory support for obtaining redress for hazardous waste and toxic injuries are examined. In establishing the regulatory scheme for state control of potential polluters, state legislatures may either affirm, repeal, or ignore any common law cause of action for damages already recognized in that state. Thirteen states have provisions in their environmental statutes which expressly state that the policy of those acts is not to preempt or change the common law and that any prior right to private action should continue in coexistence with state statute. Another type of statute is one that neither limits preexisting causes of action, nor provides new rights to private litigants. State statutes may make no reference to private litigation or redress from injuries due to hazardous waste. Under this type of statute, courts would be the most free to liberally construe the act and to apply the legislative intent to the facts of the particular case before it. Several statutes assisting the private litigant are discussed. These involve negligence, nuissance laws, apportionment of liability, rebuttable presumptions of causation, federal victim's compensation, and damages. Sixteen states have set up funds for emergency clean-up of hazardous waste spills. In the case of Florida and New Jersey, the fund is a source of recovery for injured individuals. Many states under Interim Resource Conservation and Recovery Act Authorization provide that an owner of a waste disposal site must maintain liability insurance or provide a bond sufficient to cover potential liability in the case of a spill or accidental discharge. Methods for implying a private cause of action in federal statutes are discussed. Several federal statutes providing financial recovery are outlined. These include: Social Security disability insurance, Black Lung benefits, Federal Employees Liablity Act, Longshoreman's and Harbor Worker's Compensation Act, compensation for work injuries for government employees, Veteran's Benefits, the War Risk Hazard Compensation Act, Federal Torts Claims Act, and the Price Anderson Act. (See also W88-02754) (Geiger-PTT)
W88-02762

ECONOMIC ISSUES AND ASPECTS OF HAZARDOUS WASTE MANAGEMENT,
ICF, Inc., Washington, DC.
For primary bibliographic entry see Field 5E.
W88-02763

PHOENIX DROWNING IN THE ARIZONA DESERT,
For primary bibliographic entry see Field 6D.
W88-02789

NEW ROLE FOR THE STATES IN WATER POLLUTION CONTROL FINANCING,
J. N. Smith.
Journal Water Pollution Control Federation JWPFA5, Vol. 59, No. 7, p 657-662, July 1987.

Descriptors: *Clean Water Act, *Financing, *Water pollution control, *State jurisdiction, *Federal jurisdiction, Water resources development, Water quality.

In implementing the provisions of Title VI of the Clean Water Act, EPA and the states are initiating a new phase in the national pursuit of water pollution control. To a large extent, program initiative and responsibility has shifted from the federal to the state level. State operated revolving loan funds, if properly conceived, offer a range of opportunities of responce with flexible and innovative solutions to local financing and management problems. The margin of this flexibility, in the application of Fund resources, expands exponentially as the equity in the Fund builds from interest and principal payment on the initial loans. To preserve these opportunities, while at the same time progressing with water quality objectives and protecting the future financial integrity of the Fund, is the challenge now facing the states. A lot rides on the outcome. (Alexander-PTT)
W88-02842

DEVELOPMENT DOCUMENT FOR EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS FOR THE LEATHER TANNING AND FINISHING POINT SOURCE CATEGORY,
Environmental Protection Agency, Washington, DC. Effluent Guidelines Div.
For primary bibliographic entry see Field 5D.
W88-02893

GUIDELINES FOR DEVELOPING AREA-OF-ORIGIN COMPENSATION,
Colorado Water Resources Research Inst., Fort Collins.
For primary bibliographic entry see Field 6B.
W88-03192

REGULATION REVIEW FOR UNDERGROUND STORAGE TANKS,
Wiley and Wilson, Inc., Lynchburg, VA.
B. C. Elliott, and G. G. Doby.
IN: Toxic and Hazardous Wastes, Proceedings of the Eighteenth Mid-Atlantic Industrial Waste Conference, June 29 - July 1, 1986. Technomic Publishing Co., Inc., Lancaster, PA. 1986. p 18-30, 13 ref, 2 append.

Descriptors: *Water quality management, *Underground storage, *Petroleum products, *Groundwater pollution, *Legislation, *Groundwater, Legal aspects, Storage, Water pollution, Water pollution prevention, Water pollution control, Environmental protection, Regulation, Federal jurisdiction, Water quality, Leakage, Hazardous materials, Drinking water.

U.S. Environmental Protection Agency studies indicate that thousands of the estimated 2 to 3 million underground tanks in the United States storing petroleum products or hazardous substances are leaking contributing to the pollution of the groundwater and posing a threat to those depending on groundwater as their source of drinking water. The provisions of Public Law 98-616, known as 'The Hazardous and Solid Waste Disposal Amendments of 1984,' relating to the new 'Subtitle I - Regulation of Underground Storage Tanks' are summarized. The objective of this portion of the act is to provide requirements for a comprehensive regulatory program that will lead to the detection, control, and prevention of leaks from underground storage tanks and thereby help prevent groundwater contamination. (See also W88-03223) (Wood-PTT)
W88-03225

WASTE MANAGEMENT AND REGULATORY COMPLIANCE TECHNIQUES FOR PILOT SCALE CHEMICAL PRODUCTION,
Air Products and Chemicals, Inc., Allentown, PA.
For primary bibliographic entry see Field 5E.
W88-03243

PUBLIC INVOLVEMENT IN ACCEPTABLE RISK DECISIONS,
ICF, Inc., Washington, DC.
For primary bibliographic entry see Field 5E.
W88-03258

STRATEGIES AND CHOICES IN PENNSYLVANIA'S HAZARDOUS WASTE FACILITIES PLAN,
Environmental Resources Management, Inc., West Chester, PA.
For primary bibliographic entry see Field 5D.
W88-03261

HAZARDOUS WASTE MINIMIZATION PLANNING AT THE ARMY MATERIEL COMMAND (AMC),
Army Materiel Development and Readiness Command, Alexandria, VA.
For primary bibliographic entry see Field 5D.
W88-03262

EXAMPLE EVALUATION OF A PERMIT APPLICATION FOR A PROPOSED HAZARDOUS-WASTE LANDFILL IN EASTERN ADAMS COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5G.
W88-03332

FEDERAL-STATE COOPERATIVE PROGRAM IN KANSAS, SEMINAR PROCEEDINGS, JULY 1985,

Geological Survey, Lawrence, KS. Water Resources Div.
T. L. Huntzinger.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-641, 1985. 39 p, 23 fig, 3 tab, 31 ref.

Descriptors: *Interagency, *Kansas, *Management, *Federal-state cooperation, Hydrology, Data collection, Groundwater, Surface water, Water quality, Cooperatives, Information exchange.

During the past few years, water-resource management in Kansas has undergone reorientation with the creation of the Kansas Water Authority and the Kansas Water office. New thrusts toward long-term goals based on the Kansas State Water plan demand strong communication and coordination between all water-related agencies within the State. The seminar discussed in this report was an initial step by the Kansas Water Office to assure the continued presence of a technical-coordination process and to provide an opportunity for the U.S. Geological Survey to summarize their technical-informational activities in Kansas for the benefit of State and Federal water agencies with the State. The seminar was held on July 8 and 9, 1985, in Lawrence, Kansas. The agenda included a summary of the data-collection activities and short synopses of projects completed within the past year and those currently underway. The data program discussions described the information obtained at the surface water, groundwater, water quality, and sediment sites in Kansas. Interpretive projects summarized included studies in groundwater modeling, areal hydrologic analysis, regional analysis of floods, low-flow, high-flow, and flow-volume characteristics, water quality of groundwater and lakes, and traveltime and transit-loss analysis. (USGS)
W88-03413

6G. Ecologic Impact Of Water Development

BIBLIOGRAPHY OF EFFECTS OF COMMERCIAL NAVIGATION TRAFFIC IN LARGE WATERWAYS,

Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
A. C. Miller, K. J. Killgore, B. S. Payne, and D. Buckley.
Available from the National Technical Information Service, Springfield, VA. 22161. Miscellaneous Paper E-87-1, April 1987. Final Report. 45 p, 2 fig, 1 tab, 116 ref.

Descriptors: *Bibliographies, *Navigation, *Waterways, *Environmental effects, Turbulence, Waves, Aquatic insects, Mollusks, Fish, Larvae, Suspended solids, Turbidity.

Literature dealing with the physical, biological, and chemical effects of commercial navigation traffic in large waterways is reviewed and analyzed. The majority of the information on this topic does not pertain directly to traffic, but deals with sedimentation, water quality changes, or other features of large waterways that are not always caused by passage of a commercial navigation vessel. The major physical effects of traffic are brief periods of often severe turbulence and wave wash. Water drawdown and elevated turbidity can also occur as a result of vessel passage, although environmental effects of these perturbations are usually not severe. A period of turbulence can disturb feeding and respiration of aquatic insects, mussels, and fish larvae. Brief periods of elevated suspended solids and turbidity can affect respiratory structures and sensory apparatus of aquatic organisms; however, these effects are usually temporary. Field studies on navigation traffic are difficult to design and to perform. However, the effects of traffic can be evaluated with carefully designed laboratory and field experiments. Laboratory experiments do not duplicate natural habitat conditions; however, they provide a mechanism for understanding basic effects of traffic. In the laboratory, test apparatus can be built for subjecting fish eggs and larvae, as well as freshwater mussels, to frequent and infrequent periods of turbulence and elevated suspended solids. Field manipulative experiments in which organisms are caged and transferred to sites impacted by various levels of commercial traffic provide the best technique for evaluating navigation traffic effects. These studies can be designed to evaluate traffic effects on growth rates, mortality, and physical condition of aquatic organisms. (See also W88-02533) (Author's abstract)
W88-02560

HABITAT DEVELOPMENT APPLICATIONS: MANAGEMENT OF DREDGED MATERIAL IN THE NEW ORLEANS DISTRICT,

Army Engineer District, New Orleans, LA.
R. L. Gunn.
IN: Beneficial Uses of Dredged Material, Proceedings of the First Interagency Workshop, October 7-9, 1986, Pensacola, Florida. Technical Report No. D-81-1, March 1987. Final Report. p 151-155.

Descriptors: *Dredging, *Wildlife habitat, *Louisiana, *Marsh management, *Spoil disposal, *Waste disposal, *Sediment disposal, *Project planning, *Beneficial use, Environmental effects, Salt marshes, Case studies, Maintenance, Erosion control, Bank erosion, Bank protection, Levees, Channel improvement.

In 1974, the New Orleans Corps of Engineers (CE) District began to place dredged material in the overbank areas of Southwest Pass on the Mississippi River. In 1979, banks were constructed along the channel to protect the marsh adjacent to the channel, a method that was used in the 1960's through 1980's on the upper reaches of the Barataria Waterway Project. In 1981, 600 acres of marsh were constructed from dredged material on the Bayou Chene Project. Loss of dikes and erosion along the channel resulted in the loss of 50% of this marsh. Three beneficial uses of dredged material resulted from the New Orleans CE District maintenance project. First, bank nourishment of Grand Lake was undertaken. Second, marsh creation was designated for a number of disposal areas. Third, along the Gulf Intracoastal Waterway from Mississippi to Texas, long stretches of marsh are located adjacent to the channel with no alternate dispoal areas to reduce the impact of the disposal of dredged material on the existing marsh. Dredged material has been placed between the existing levees and the new levees under construction at the Lacassine Wildlife Refuge. The Mermentau River Maintenance Project included marsh creation in Lower Mud Lake. At Tiger Pass, 230 acres of marsh were created. In the Atchafalaya Delta 1000 acreas of marsh were created. On the Mississippi River-Gulf Outlet 20 acres of marsh in an inland confined disposal area and 33 acres in Breton Sound adjacent to the west jetties were formed. The Calcasieu River Project has marsh creation in two disposal areas. A major new construction project which will include marsh creation is the Mississippi River Ship Channel. Upcoming maintenance projects which may include the use of dregded material to enhance the environment are the Gulf Intracoastal Waterway, Atchafalaya River to Vermilion River reach; Gulf Intracoastal Waterway, Alternate Route, Bayou Sorrel to Morgan City; Barataria Bay Waterway, Mile 2.36 to Mile 30.7; Mermentau River, Mile 24 to the Gulf of Mexico; and the Mississippi River Outlets at Venice, Tiger Pass, and Baptiste Collette. Plans are underway to initiate additional and continued marsh creation at Southwest Pass. (See also W88-02563) (Geiger-PTT)
W88-02572

INDUSTRIAL AND COMMERICAL APPLICATIONS: DREDGING FOR LAKE RESTORATION,

Port of Vancouver, WA.
For primary bibliographic entry see Field 2H.
W88-02576

CLASS III CULTURAL RESOURCE SURVEY OF THE GERANIUM CANAL AND LATERAL SYSTEM, VALLEY COUNTY, NEBRASKA,

Powder River Consultants, Vermillion, SD.
P. S. Miller, and F. R. Chapman.
Available from the National Technical Information Service, Springfield, Virginia. 22161, as PB84-240498. Price codes: A05 in paper copy, A01 in microfiche. Final Report, December 1983. 78 p, 3 fig, 4 tab, 22 ref. Bureau of Reclamation Contract No. 3-CS-70-00520.

Descriptors: *Archaeology, *Canals, *Surveys, History, Social aspects, Environmental effects.

A field survey of the proposed rights of way for the Geranium canal and laterals was conducted during July 1983. This was accompanied by a files search, document review, and informant interviews. Two prehistoric and fourteen historic sites were recorded. The prehistoric remains are suggestive of the Upper Republican and Dismal River complexes. Five of the historic sites have structures with sufficient age and integrity to warrant nomination to the National Register of Historic Places. Four homesteads and a site with two structures are associated with the homesteading, development and socio-economic continuity of the major ethnic group of Valley County, Nebraska. The Bohemian steelers to the county have concentrated in Geranium Township, the chief area for the canal project. Further evaluation should emphasize the relationships between the homesteads, standing structures and the ethnic community, including the study of folk architecture. (See also W88-02563) (Author's abstract)
W88-02588

INTERACTION BETWEEN A NATURAL SNOWFALL AND A COOLING TOWER PLUME: AN EXPERIMENTAL STUDY WITH A MILLIMETRIC DOPPLER RADAR,

Clermont-Ferrand-2 Univ., Lannemezan (France). Center of Atmospheric Research.
B. Campistron.
Atmospheric Environment ATENBP, Vol. 21, No. 6, p 1375-1383, June 1987. 7 fig, 1 tab, 13 ref.

Descriptors: *Radar, *Remote sensing, *Snow, *Thermal plumes, Nuclear power plants, Precipitation, Scavenging.

A precipitation band, about 30 km long and 2 km wide, downwind of a nuclear power plant was observed with a millimetric Doppler radar. The three-dimesional radar analysis showed that this band resulted from the growth, by a seeder-feeder process, of a natural snowfall falling in the moist plume produced by the exhaust of the nuclear plant. At the exit from the 0.6 km deep plume, the mean snow precipitation rate was approximately enhanced by a factor of two. This corresponds to an extraction rate of water in the plume by snow scavenging of 600 kg/s, that is about one third of the water injection rate into the atmosphere by the cooling towers. (Author's abstract)
W88-02686

LEGIONELLA AND THE ENVIRONMENT,

Pittsburgh Univ., PA. Dept. of Industrial Environmental Health Sciences.
For primary bibliographic entry see Field 5F.
W88-02798

ENVIRONMENTAL IMPACT ANALYSIS OF THE SARYU CANAL IRRIGATION PROJECT AND GUIDELINES FOR ITS MANAGEMENT,

M.L.K. Coll., Balrampur (India).
A. Afroz, and P. P. Singh.
Journal of Environmental Management JEVMAW, Vol. 24, No. 4, p 297-313, June 1987. 3 fig, 7 tab, 38 ref.

Descriptors: *Environmental impact, *Saryu Canal, *Irrigation projects, *Environmental management, *Irrigation management, Soil quality, Water table, Climate, Case studies, Canals, Rainfall, India.

The results of hydro-edaphological studies in the Saryu Canal irrigation project of the U. P. Government, India, are analyzed, including an assessment of impact on the local environment, analysis of climatic regimes, evaluation of the underground

water table, and characterization of soil qualities. It is perhaps the first instance where a case study has been made at the construction stage of a major canal irrigation project. The findings of the study should be considered carefully and adopted so that the natural water resources may be monitored and preserved from catastrophic consequences. The analysis of annual, seasonal and monthly rainfall in the catchment area indicates that the kharif season (July-October) has the heaviest rainfall, and high yield can be achieved without irrigation. The heavy one-day rainfall coupled with rain on 2 or 3 consecutive days causes serious surface drainage problems. The construction of a canal without adequate surface drainage will aggravate the environmental problems in this area. The construction has also caused serious environmental impacts on the flora, fauna, human populations, grazing land and forest has been destroyed. The removal of trees during the canal's construction has adversely affected the Motipur Wildlife Sanctuary and the Bhinga Reserve Forest, both rich in wildlife. There is concern that the area may lose the deer population. Problems expected after the project has been brought into operation include flood hazards, waterlogging and salinity, seepage and sedimentation, and biological problems due to the high water table, high seepage rate, and sandy texture of the soil. (Author's abstract)
W88-02863

SOME INVESTIGATIONS RELATING TO ENVIRONMENTAL IMPACTS OF A WATER RESOURCE PROJECT,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Industrial Engineering and Management.
R. P. Mohanty, and T. Mathew.
Journal of Environmental Management JEVMAW, Vol. 24, No. 4, p 315-336, June 1987. 12 fig, 6 tab, 5 ref.

Descriptors: *Environmental impact, *Idukki project, *Environmental management, *Hydroelectric management, *Hydroelectric power, *Water resources development, Social aspects, Developing countries, India, Ecology, Model studies, Planning.

The Idukki hydroelectric project of India is reviewed and the various impacts are assessed. The objective of the investigation is to establish some factual premises to enhance the knowledge base for water resource project planning and management in a developing country. It is observed that because of unplanned human interventions many of the developmental projects are destroying the ecological balance and creating irreversible damage to the social fabric. In order to establish a compatible as well as harmonious relationship between human systems and the natural system through development programs, it may be essential to formulate and validate a mixed programming action research model to guide the management decision-makers in reaching appropriate pro-active or adaptive decisions. (Author's abstract)
W88-02864

RECOVERY AND ADJUSTMENT OF AQUATIC VEGETATION WITHIN CHANNELIZATION WORKS IN ENGLAND AND WALES,
Freshwater Biological Association, Wareham (England). River Lab.
A. Brookes.
Journal of Environmental Management JEVMAW, Vol. 24, No. 4, p 365-382, June 1987. 7 fig, 6 tab, 48 ref. Natural Environment Research Council CASE Studentship GT4/80/AAPS/44.

Descriptors: *Environmental impact, *Vegetation, *Channelization, Species composition, Standing crops, Recovery, England, Wales, Channels.

The short-term recovery of vegetation following channelization is assessed at seven sites in south central England in terms of standing crop and species composition. Recovery depends on plant rhizomes which may still be present in the bed of the channel after construction, or on the species present in the unaffected channel upstream, but is also dependent on the morphological variables which are changed during construction, most notably the width, depth and grain-size composition of the substrate. Vegetation surveys taken at a further 22 sites in England and Wales, at which channelization had been completed up to 24 years previously, indicate that destruction of the original substrate, significant changes of width or depth, and the removal of bankside vegetation may have long-term impacts on the vegetation. Because the recovery of vegetation may be desirable in channelized reaches in England and Wales to improve the biological and aesthetic qualities, some preliminary recommendations are presented. Undesirable consequences can be avoided by minimizing the widening and deepening of channels and by recognizing the importance of the original substrate. Excessive growth of aquatic vegetation within channelized reaches, undesirable from the engineering viewpoint, may result from the removal of trees for machinery access, and thus the benefit of shade. (Author's abstract)
W88-02865

POTENTIAL EFFECT OF FLOATING DOCK COMMUNITIES ON A SOUTH CAROLINA ESTUARY,
South Carolina Univ. at Beaufort.
For primary bibliographic entry see Field 2L.
W88-02877

AQUATIC HABITAT STUDIES ON THE LOWER MISSISSIPPI RIVER: RIVER MILE 480-530; REPORT 8, SUMMARY,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
T. D. Wright.
Available from the National Technical Information Service, Springfield, VA 22161, as ADA-117519, A03 in paper copy, A01 in microfiche. Miscellaneous paper E-80-1, February 1982. Report 8 of a Series. 41 p, 6 fig, 4 tab.

Descriptors: *Environmental effects, *Waterways, *Aquatic habitats, Invertebrates, Habitats, Mississippi River, Aquatic animals, Aquatic life, Macroinvertebrates, Benthos, Channels, Dikes, Sand, Banks, Streams banks, Flow control, Fish.

Pilot investigations of aquatic animals on a 50-mile reach of the Lower Mississippi River produced significant guidance in selecting methods and experimental design for a long-term project. Aquatic habitat mapping, benthic macroinvertebrate analysis, studies of diel drift of macroinvertebrates, fish studies, and the use of nonsense codes for data processing proved helpful. Each of these studies are documented in separate reports. (Cassar-PTT)
W88-02920

STATE-OF-THE-ART FOR ASSESSING EARTHQUAKE HAZARDS IN THE UNITED STATES, REPORT 19: THE EVIDENCE FOR RESERVOIR-INDUCED MACROEARTHQUAKES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Geotechnical Lab.
For primary bibliographic entry see Field 8E.
W88-02921

SURVEY OF THE FRESHWATER MUSSELS OF THE LOWER CUMBERLAND RIVER FROM BARKLEY DAM TAILWATER DOWNSTREAM TO THE OHIO RIVER,
Murray State Univ., KY. Dept. of Biological Sciences.
J. R. Sickel.
Final Report, March 19, 1982. Army Engineer District, Nashville, TN. 24 p, 4 fig, 3 tab, 2 ref.

Descriptors: *Mussels, *Mollusks, *Dredging, Tailwater, Sedimentation, Ecosystems, Aquatic habitats, Dams, Dam effects, Environmental effects.

A survey was conducted to determine the species, location, relative density and habitat characteristics of mussels. Proposed dredging and disposal sites were also examined to estimate the potential impact of navigation improvement activities upon the mussels. Twenty-one species of mussels in 16 genera still survive in the lower Cumberland River. Mussel beds were found only in stable habitats which have probably been undisturbed for many years and which consist of gravel in a firm sandy-clay. Extreme daily fluctuations in discharge through the dam and high silt loads may have an adverse influence on reproduction and host fish distribution. (Halterman-PTT)
W88-02923

REPORT OF A CLASS III CULTURAL RESOURCES SURVEY OF THE CANAL AND LATERAL RIGHTS-OF-WAY OF THE PLANNED SCOTIA CANAL, NORTH LOUP DIVISION IN VALLEY, GREELEY AND HOWARD COUNTIES, NEBRASKA; VOLUME 1,
Augustana Coll., Sioux Falls, SD.
E. J. Lueck, L. A. Hannus, and M. K. Ritter.
Archeological Contract Series, Number 15, December 1984. 58 p, 10 fig, 6 tab, 11 plates, 43 ref, 2 append. Contract No. 4-CS-70-00390.

Descriptors: *Environmental effects, *Archaeology, *Right-of-way, Canals, Waterways, Water resources development, Scotia Canal, Nebraska.

The proposed rights-of-way for the Scotia Canal and lateral system in Nebraska were surveyed. In the 730.35 acres along 55.1 miles of waterway, three prehistoric sites, three prehistoric isolated finds, and 13 historic sites were recorded. Only one prehistoric site lies within the project area. This relatively unique site, associated with the Plains Archaic period, contains aboriginal lithic and burned bone scatter. It will require a determination of eligibility for the National Register of Historic Places. The two isolated finds within the project area lack sufficient remains to require further work. Of the 13 historic sites, ten lie within the project rights-of-way. None of the historic structures meet the criteria for nomination to the National Register of Historic Places. Most consist of standing structures or ruins of abandoned homes and farms. (Cassar-PTT)
W88-02933

HOHOKAM ARCHAEOLOGY ALONG THE SALT-GILA AQUEDUCT CENTRAL ARIZONA PROJECT: VOLUME VI: HABITATION SITES ON THE GILA RIVER, PARTS V AND VI.
Arizona State Museum, Tucson. Cultural Resource Management Div.
Archaeological Series No. 150, 1983. Edited by Lynn S. Teague and Patricia L. Crown. 238 p, 40 fig, 15 tab, 214 ref, 7 append.

Descriptors: *Environmental effects, *Canals, *Aqueducts, *Archeology, Central Arizona Project, Salt-Gila Aqueduct, Hohokam, Indians, Los Fosas archeological site, Arizona.

This volume is one of nine which report the archeological findings along the site of the Salt-Gila Aqueduct. Eight prehistoric habitation sites, representing Colonial through Classic Period Hohokam occupation, were excavated in the Florence, Arizona, area as part of this project. Volume 4 includes descriptive reports of excavations at these sites as well as site-specific interpretations. Part V describes the Las Fosas site; Part VI, two unnamed sites. The Las Fosas site, which dates to the Classical period, is apparently intact and undisturbed in spite of heavy construction in the area. The aqueduct right-of-way encompasses over half of this site, including all the architectural features. One of the unnamed sites is viewed as only a portion of a larger site that may have been destroyed by construction or which may be beneath the Arizona State Prison. A flotation sample from a trash pit at the other unnamed site yielded mostly plant remains representing a cross section of Santa Cruz phase subsistence. (Cassar-PTT)
W88-02942

MULTIVARIATE WATER QUALITY INDEX FOR USE IN MANAGEMENT OF A WILDLAND WATERSHED,
Utah Center for Water Resources Research,

Logan.
For primary bibliographic entry see Field 5G.
W88-02959

PRELIMINARY ASSESSMENT OF LAND-SURFACE SUBSIDENCE IN THE EL PASO AREA, TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
L. F. Land, and C. A. Armstrong.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4155, 1985. 96 p, 23 fig, 9 tab, 45 ref.

Descriptors: *Subsidence, *Groundwater level, *Alluvial deposits, *Texas, Compressibility, Water loss, Leakage, Clays, Aquifers, Hueco bolson, El Paso, Bench marks.

The Hueco bolson deposits in the El Paso area consist mostly of lenses of gravel, sand, silt, and clay. In the Rio Grande Valley, about 400 to 450 feet of these deposits have been eroded and replaced with as much as 200 feet of alluvium. Groundwater in the shallow alluvial aquifer in the Rio Grande Valley in the Hueco bolson aquifer outside the valley is under water table conditions, whereas groundwater in the bolson aquifer in the valley is under leaky artesian conditions. In the downtown area of El Paso, water level declines of 125 and 150 feet have occurred in the shallow and Hueco bolson aquifers, respectively. Surveys that releveled bench marks along lines to the northeast, the southeast, and along the Rio Grande commonly show subsidence of 0.2 foot and a maximum of 0.41 foot near the river. A comparison of subsidence, water level declines, and clay thickness along the three survey lines shows the expected correlation of greater subsidence for thicker accumulated clay material for a given decline in water levels. Data are not sufficient to determine if the preconsolidation stress has been exceeded. (USGS)
W88-03009

GROUND-WATER LEVELS AND USE OF WATER FOR IRRIGATION IN THE SARATOGA VALLEY, SOUTH-CENTRAL WYOMING, 1980-81,
Geological Survey, Cheyenne, WY. Water Resources Div.
L. W. Lenfest.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4040, 1986. 24 p, 16 fig, 2 tab, 8 ref, 3 pl.

Descriptors: *Groundwater irrigation, *Water use, *Aquifers, *Water level fluctuations, *Wyoming, *Saratoga Valley, *Groundwater development, Potentiometric levels, Irrigation wells, Observation wells, Transmissivity, Pumpage, Kriging, North Platte River.

Although surface water is the principal source of irrigation water in the Saratoga Valley, Wyoming, development of groundwater for irrigation is increasing. Most of the 30 irrigation wells in the valley are capable of producing more than 200 gallons per minute. Approximately 2,700 acre-feet of groundwater for irrigation were pumped from the shallow aquifer during 1980 and 4,200 acre-feet during 1981. The shallow aquifer, the subject of this study, consists of the North Park Formation and a lower sandstone unit of late Tertiary (Miocene) age and deposits of Quaternary age along the North Platte River. During 1980, water levels were measured in about 140 wells, 41 of which had been measured prior to 1969. The 1980 water levels were within 5 feet of the pre-1969 water levels. During 1980-81, 21 of the wells were used as observation wells. A water-level contour map of the study area was prepared by the Kriging statistical procedure water surface altitudes for 235 groundwater and stream locations. The map indicates that the direction of groundwater flow is from the borders of the study area toward the North Platte River and north-westerly (downstream) parallel to the river. (USGS)
W88-03025

EFFECTS OF URBAN DEVELOPMENT OF HYDROLOGY OF THE REEDY CREEK IMPROVEMENT DISTRICT, CENTRAL FLORIDA,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 4C.
W88-03034

EVALUATION OF THE MISSION, SANTEE, AND TIJUANA HYDROLOGIC SUBAREAS FOR RECLAIMED-WATER USE, SAN DIEGO COUNTY, CALIFORNIA,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
For primary bibliographic entry see Field 5D.
W88-03051

GEOHYDROLOGIC DATA ALONG THE SALT-GILA AQUEDUCT OF THE CENTRAL ARIZONA PROJECT IN MARICOPA AND PINAL COUNTIES, ARIZONA,
Geological Survey, Phoenix, AZ. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03070

EFFECTS OF HARVESTING CYPRESS SWAMPS ON WATER QUALITY AND QUANTITY,
Florida Univ., Gainesville. Dept. of Forestry.
K. C. Ewel.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-157096/AS. Price codes: A04 in paper copy, A01 in microfiche. Florida Water Resources Research Center, Gainesville, Publication 87. September 1985. 50 p, 23 fig. Contract No. 14-08-0001-G899. Project No. USGS G899-03; UF Project 125747010.

Descriptors: *Cypress swamps, *Evapotranspiration rates, *Florida, *Harvesting, *Swamps, Forested wetlands, Silviculture, Withlacoochee State Forest, Hernando County, Organic nitrogen.

The responses of cypress swamps to a spectrum of harvest techniques are being studied in the Withlacoochee State Forest, Hernando County, Florida. Among the 11 swamps in the study area, four contain plots that were harvested experimentally in 1984. Stand improvement cuts were made in plots in two large swamps. In two other large swamps, plots were thinned to three different levels of basal area: 16, 25, and 34 sq m/ha. Two additional large swamps will be partially clearcut in wedges, and another small swamp will be completely clearcut. Three swamps will serve as controls for this last group of swamps. Measurements of tree biomass were made in all but two of the large swamps. The swamps were surveyed for cone production in the fall and regeneration in the spring. Cone production was poor in all swamps, and a few seedlings were found the following spring. However, coppice was produced in all the harvested plots. These preliminary results suggest that coppice production may be a dependable regeneration method, although it may not be desireable for stand improvement cuts and thinning. Evapotranspiration from three cypress swamps averaged 79 cm over a 3-yr period. This represented 52% of rainfall at the site. This rate was 77% of the average evapotranspiration rate measured in pine flatwoods in north Florida during the same time. These data confirm earlier reports of low evapotranspiration rates in cypress swamps. A preliminary analysis of nitrogen concentrations in harvested and control swamps suggests that harvesting may increase organic nitrogen concentrations in the water column during the harvest operation. However, these higher concentrations appear to be shorter lived. (Brandt-U. FL.)
W88-03151

ANALYSIS OF WETLAND TRENDS AND MANAGEMENT ALTERNATIVES FOR GEORGIA,
Georgia Univ., Athens. Inst. of Natural Resources.
For primary bibliographic entry see Field 4C.
W88-03155

PUBLIC RESPONSE TO THE DISCOVERY OF WATER CONTAMINATION,
New Hampshire Univ., Durham. Dept. of Sociology.
L. Hamilton.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-198090/AS. Price codes: A05 in paper copy, A01 in microfiche. New Hampshire Water Resources Research Center, Durham, Research Report 50. October 1985. 75 p, 7 fig, 16 tab, 30 ref. Contract No. USGS G-920-02. Project No. A-063-NH.

Descriptors: *Water pollution, *Public attitudes, *Social aspects, Contamination, Decision making, Water pollution effects, Surveys.

This study examines data from public opinion surveys regarding water supply pollution and protection issues. The surveys were conducted in several New England communities with ongoing or potential water quality problems. Results show that people generally place a high priority on water protection, even in communities where no recent crisis has raised public awareness. When no crisis has occurred, more educated and environmentally active citizens are the group with the deepest concern. After a crisis, concern is much broader, and does not correlate with education. Younger adults, parents of young children, and women are the groups most concerned after contamination has been discovered. The pattern of change in the demographic predictors of concern about water quality suggests that there is a shift in the way this issue is perceived. Before a crisis has occurred, water quality is typically viewed as an 'environmental' issue. After a crisis, water quality becomes viewed as a 'safety' issue, and particularly as a threat to the safety of one's children. Public concern is greatly intensified as a result of this shift. Conflicts may arise when authorities responding to the crisis misunderstand the sources and intensity of such related concern. (Hamilton-Water Resource Research Center/UHN2)
W88-03187

CHANGES IN THE FAUNAL COMPOSITION OF TWO THERMAL STREAMS NEAR TAUPO, NEW ZEALAND,
Department of Scientific and Industrial Research, Taupo (New Zealand). Taupo Research Lab.
M. James.
New Zealand Journal of Marine and Freshwater Research NZJMBS, Vol. 19, No. 4, p 439-443, 1985. 1 fig, 1 tab, 22 ref.

Descriptors: *Aquatic animals, *Species composition, *Thermal streams, *Thermal water, *Taupo, *Environmental effects, *New Zealand, *Distribution patterns, Streams, Aquatic life, Water cooling, Aquatic insects, Dragonflies, Caddisflies, Mollusks, Temperature, Water temperature, Fish.

The distributions of macroinvertebrates in two thermal streams near Taupo, New Zealand were examined and compared with observations made in 1966. The cooling of the streams associated with abstraction of hot water for thermal baths has altered the species composition. Odonata and Trichoptera were recorded for the first time in the lower reaches of the Waipahihi Stream, whereas Ephydridae and Hydrophilidae were restricted to the upper reaches at temperatures above 33.5 C. Mollusks dominated the fauna at sites with temperatures below 33.5 C in the Waipahihi and Waipuwerawera Streams. Potamopyrgus antipodarum was present at sites with temperatures below 28 C. Changes in the distribution of some species, e.g., Physa acuta in the Waipuwerawera Stream and Cladopelma curtivalva and Lymnaea columella in the Waipahihi Stream do not appear to be temperature-related. These results show that development and alterations to thermal streams can have a significant effect on stream faunas that are adapted to specific temperature regimes. (Doria-PTT)
W88-03198

ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY FOR MAJOR RESOURCE DEVELOPMENTS,
Department of the Environment, Hull (Quebec).
D. S. Wright, and G. D. Greene.
Journal of Environmental Management JEVMAW, Vol. 24, No. 1, p 1-16, January 1987. 6 fig, 6 ref.

Descriptors: *Environmental impact statement, *Resources development, *Saskatchewan, *Project planning, *Environmental policy, Exploitation, Planning, Social aspects, Economic aspects, Ecology, Safety, Water quality management, Environmental effects.

An environmental assessment methodology is described that was developed for a major mining project in Saskatchewan, Canada, and is applicable to various types of resource developments. A team of experts in aquatic ecology, air quality, terrestrial ecology, occupational health and safety, and socioeconomic studies developed and applied the methods under the direction of an assessment coordinator. The team worked together to assure that impacts were assessed in an integrated manner, allowing links between environmental components to be addressed. Impacts were assessed within a framework structured enough to be consistent, but flexible enough to accommodate differences between environmental components. The methodology can be applied reiteratively to allow the results to be used in the engineering design of a project. (Dori-PTT)
W88-03211

WEBER BASIN PROJECT HISTORICAL CULTURAL RESOURCES STUDY.
Cooper/Roberts Architects, Salt Lake City, UT.
Available from the National Technical Information Service, Springfield, Virginia. 22161 as PB87-158432, A06 in paper copy, A01 in microfiche. Final Report, October 24, 1986. 98 p. Bureau of Reclamation Contract No. 6-CP-40-03730.

Descriptors: *Cultural resources, *Resources management, *Water management, *History, *Municipal water, Data interpretation, Irrigation, Irrigation water, Industrial water, Utah, Weber Basin Project.

The Bureau of Reclamation required a study of historic cultural resources in a portion of the Weber Basin Project area to comply with Federal laws and regulations. The Weber Basin Project was constructed in the 1950's and 1960's to supplement two earlier Reclamation water projects, the Weber River and Provo River Projects. The Weber Basin Project supplies water for both irrigation and municipal and industrial (M and I) use in Davis, Morgan Summit, and Weber Counties, Utah. The activity requiring the cultural resources study is the conversion of authorized use of between 20,000 and 40,000 acre-feet of water per year from irrigation to M and I. A reconnaissance level block survey was conducted in five communities in northern Utah: Hooper, Plain City, Huntsville, Farmington, and Eden, Weber County and Davis County. Of the 2828 structures recorded, 472 (17%) were considered to be potentially eligible for inclusion in the National Register. Some completed Utah Historic Computer System Block Survey forms are presented and the forms, city plat maps, black and white photographs and color slides are on file at the Utah State Historical Society, Salt Lake City, Utah. (Author's abstract)
W88-03272

EVALUATION OF MANATEE HABITAT SYSTEMS ON THE NORTHWESTERN FLORIDA COAST,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
J. M. Packard, and O. F. Wetterqvist.
Coastal Zone Management Journal CZMJBF, Vol. 14, No. 4, p 279-310, 1986. 7 fig, 3 tab, 35 ref. Florida Cooperative Fish and Wildlife Research Unit Agreement 14-16-0009-1544.

Descriptors: *Manatee habitats, *Manatees, *Coastal zone management, *Coastal waters, Water pollution effects, Water development, Management planning, Environmental effects, Animal populations, Habitats, Mammals, Aquatic habitats, Florida, Mapping, Water use, Competing use, Planning.

Threats to the survival of West Indian manatees (Trichechus manatus) vary throughout their range so that protection of this endangered species requires careful planning on a regional and local basis. The importance and vulnerability of various components of manatee habitats in the Crystal River area of northwestern Florida were assessed, using an ordinal-combination mapping technique similar to procedures practiced in urban and regional planning. Habitat components were mapped and evaluated in juxtaposition with relevant characteristics of human use of the area, to identify areas of existing and potential manatee/human conflicts in need of reconciliation. Areas evaluated as the most important manatee habitats within this region include Crystal Bay and River, Homosassa River, and the Suwannee River estuary. Existing overlap of human activities with important manatee habitats is most critical near the urban communities of Crystal River and, to a lesser degree, Homosassa Springs. The need for integration of this ecological information into coastal land-use planning is discussed. (Author's abstract)
W88-03289

LAND ACQUISITION CRITERIA FOR THE SUWANNEE RIVER ESTUARY, FLORIDA,
For primary bibliographic entry see Field 6B.
W88-03295

7. RESOURCES DATA

7A. Network Design

TECHNIQUES FOR MONITORING STABILITY OF OFFSHORE SUBMERGED DISPOSAL MOUNDS,
Coastal Engineering Research Center, Vicksburg, MS.
E. B. Hands.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 11th U.S./Japan Experts Meeting, November 4-6, 1985, Seattle, WA. April 1987. p 262-263.

Descriptors: *Waste disposal, *Disposal sites, *Water quality control, *Dredging, *Sediment disposal, *Monitoring, Hydrograph analysis, Seismographs, Sounding, Sediment traps.

The physical fate of dredged material released in the marine environment often is of vital concern. If currents spread the material beyond the disposal site, problems could arise, such as shoaling of adjacent channels or smothering of biological resources. In other instances spreading may be desirable, for example, to increase site capacity, nourish adjacent beaches, or simply return the material to the natural system from which it was captured. Hydrographic surveys can document changes in the shape of any substantial sediment accumulation. Subbottom seismic reflections can reveal subsidence of the foundation beneath the accumulated materials. Side-scan sonar surveys record the surface characteristics across wide swaths of the bottom, and can be used to identify and map edges of disposal deposits which are too thin to be recognized on sounding or seismic profiles. The foregoing techniques use readily available equipment. New technology offering potential for monitoring disposal deposits includes: (1) swath sounding systems that, from a single pass, reveal a three-dimensional picture of the bottom; (2) seabed drifters that move with the bottom currents and indicate where moving sediments may accumulate; and (3) sediment traps that can be used in conjunction with current meters to quantify sediment movement. Because of the usual demands and expense of working at sea and the challenge of distinguishing native from disposed material, as many of these overlapping techniques as possible should be incorporated into any survey plans. Mobilization and boat time are major cost items. Thus, multiple element surveys often provide not only the best insurance of success, but also the most cost-effective approach for tracking disposed material. (See also W88-02513) (Lantz-PTT)
W88-02531

OVERVIEW OF METHODS FOR GROUND WATER INVESTIGATIONS,
Water Research Centre, Medmenham (England). Medmenham Lab.
For primary bibliographic entry see Field 2F.
W88-02543

METHODS FOR THE ASSESSMENT OF GROUND WATER POLLUTION POTENTIAL,
National Center for Ground Water Research, Norman, OK.
L. W. Canter.
IN: Ground Water Quality, John Wiley and Sons, New York, NY. 1985. p 270-306, 1 fig, 22 tab, 15 ref.

Descriptors: *Groundwater pollution, *Water pollution sources, *Groundwater quality, Water quality control, Monitoring, Water sampling.

Empirical assessment methodologies can be useful tools for comparative evaluations of groundwater pollution sources, site selection, and the planning and conduction of groundwater monitoring programs. Three empirical assessment methodologies (surface impoundment assessment, waste-soil-site interaction matrix, and site rating system are reviewed). The Surface Impoundment Assessment methodology was applied to 77 wastewater ponds, 13 septic tank system areas, and 10 landfills in the central Oklahoma area overlying the Garber-Wellington aquifer. New prioritization methodologies were developed for oil and gas wells and dry holes as well as for salt water disposal wells and waterflood operations. These methodologies were applied to 14,127 oil and gas wells and dry holes, and 1051 salt water disposal wells and waterflood operations in the study area. A field sampling program in 13 of the top 57 sections (2% of the total number of sections) revealed that 12 exhibited evidence of increased TDS in aquifers used as drinking water sources. Several research needs can be identified in conjunction with empirical assessment methodologies. Field verification studies, professional input into methods development, and more structured value judgment approaches are needed. Although several methodologies have been developed, and additional methodologies are planned, only cursory field verification of the results of methodologies has been conducted. The empirical assessment methodologies generally tend to be developed by single persons or small groups of professional, and there is need for greater input from a wider range of professionals associated with groundwater quality management. Because empirical assessment methodologies require the considerable exercise of value judgment, more structured approaches for soliciting value judgements are needed. (See also W88-02533) (Lantz-PTT)
W88-02545

TRANSFER OF HYDROLOGIC INFORMATION AMONG RIVER POINTS,
George Washington Univ., Washington, DC. International Water Resources Inst.
For primary bibliographic entry see Field 2E.
W88-02770

MODIFIED LINEAR PROGRAMMING GRADIENT METHOD FOR OPTIMAL DESIGN OF LOOPED WATER DISTRIBUTION NETWORKS,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Industrial Engineering and Management.
For primary bibliographic entry see Field 5F.
W88-02775

SMALL-AREA SNOW SURVEYS ON THE NORTHERN PLAINS OF NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
G. Emerson, T. R. Carroll, and H. Steppuhn.

Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4026, 1985. 22 p, 3 fig, 7 tab, 17 ref.

Descriptors: *Snow surveys, *North Dakota, Snow cover, Snow density, Snow depth, Remote sensing, Aerial snow survey.

The variation in snow cover over small areas is the focus of this study of the feasibility of using aerial surveys to obtain information on the snow water equivalent of the snow cover in order to minimize the necessity of labor intensive ground snow surveys. A low-flying aircraft was used to measure attenuations of natural terrestrial gamma radiation by snow cover. Aerial and ground snow surveys of eight 1-mile snow courses and one 4-mile snow course in North Dakota were used in the evaluation, with ground snow surveys used as the base to evaluate aerial data. Each of the 1-mile snow courses consisted of a single land use and all had the same terrain type (plane). The 4-mile snow course consists of a variety of land uses and the same terrain type (plane). Using the aerial snow-survey technique, the snow water equivalent of the 1-mile snow courses was measured with three passes of the aircraft. Use of more than one pass did not improve the results. The mean absolute difference between the aerial- and ground-measured snow water equivalents for the 1-mile snow courses was 26 percent (0.77 inches). The aerial snow water equivalents determined for the 1-mile snow courses were used to estimate the variations in the snow water equivalents over the 4-mile snow course. The weighted mean absolute difference for the 4-mile snow course was 27 percent (0.8 inches). Variations in snow water equivalents could not be verified adequately by segmenting the aerial snow-survey data because of the uniformity found in the snow cover. On the 4-mile snow course, about two-thirds of the aerial snow-survey data agreed with the ground snow-survey data within the accuracy of the aerial technique (+or-0.5 inch of the mean snow water equivalent). (USGS)
W88-03057

COST-EFFECTIVENESS OF THE U.S. GEOLOGICAL SURVEY'S STREAM-GAGING PROGRAMS IN MASSACHUSETTS AND RHODE ISLAND,
Geological Survey, Boston, MA. Water Resources Div.
R. A. Gadoury, J. A. Smath, and R. A. Fontaine.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4097, 1985. 78 p, 17 fig, 22 tab, 21 ref.

Descriptors: *Hydrologic data collection, *Network design, *Cost benefit analysis, *Operating cost, *Massachusetts, *Rhode Island, Optimization, Alternative planning, Scheduling.

The report documents the results of a study of the cost-effectiveness of the U.S. Geological Survey's continuous-record stream-gaging programs in Massachusetts and Rhode Island. Data uses and funding sources were identified for 91 gaging stations being operated in Massachusetts are being operated to provide data for two special purpose hydrologic studies, and they are planned to be discontinued at the conclusion of the studies. Cost-effectiveness analyses were performed on 63 continuous-record gaging stations in Massachusetts and 15 stations in Rhode Island, at budgets of $353,000 and $60,500, respectively. Current operations policies result in average standard errors per station of 12.3% in Massachusetts and 9.7% in Rhode Island. Minimum possible budgets to maintain the present numbers of gaging stations in the two States are estimated to be $340,000 and $59,000, with average errors per station of 12.8% and 10.0%, respectively. If the present budget levels were doubled, average standards errors per station would decrease to 8.1% and 4.2%, respectively. Further budget increases would not improve the standard errors significantly. (USGS)
W88-03059

COST EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
H. N. Flippo, and T. E. Behrendt.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4077, 1985. 108 p, 10 fig, 24 tab, 21 ref.

Descriptors: *Streamflow-data program, *Pennsylvania, *Delaware River Basin, *Susquehanna River Basin, Stream gaging, Cost effectiveness, Funding, Surface water.

This report documents a cost-effectiveness study of the stream-gaging program in Pennsylvania. Data uses and funding were identified for 223 continuous-record stream gages operated in 1983; four are planned for discontinuance at the close of water-year 1985; two are suggested for conversion, at the beginning of the 1985 water year, for the collection of only continuous stage records. Two of 11 special-purpose short-term gages are recommended for continuation when the supporting project ends; eight of these gages are to be discontinued and the other will be converted to a partial-record type. Current operation costs for the 212 stations recommended for continued operation is $1,199,000 per year in 1983. The average standard error of estimation for instantaneous streamflow is 15.2%. An overall average standard error of 9.8% could be attained on a budget of $1,271,000, which is 6% greater than the 1983 budget, by adopted cost-effective stream-gaging operations. (USGS)
W88-03061

DRAINAGE-AREA DATA FOR WISCONSIN STREAMS,
Geological Survey, Madison, WI. Water Resources Div.
E. W. Henrich, and D. N. Daniel.
Available from USGS, OFSS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 83-933, 1985. 322 p, 5 fig, 11 tab, 1 ref.

Descriptors: *Drainage area, *River basins, River mouth, Wisconsin, Topographic divides, Topographic quadrangles, Accuracy, Contour intervals.

Drainage areas were delineated on U.S. Geological Survey topographic maps and determined for more than 7,000 sites in Wisconsin's 11 major river basins, including all named streams draining 5 or more square miles, and all unnamed streams draining 10 or more square miles. Drainage areas also were determined at gaging stations, sewage-treatment plants, dams, major highway crossings, sites where discharge measurements are available, and sites where water samples are collected for chemical analysis. (USGS)
W88-03082

WATER QUALITY DATA-COLLECTION ACTIVITIES IN COLORADO AND OHIO: PHASE I--INVENTORY AND EVALUATION OF 1984 PROGRAMS AND COSTS,
Geological Survey, Columbus, OH. Water Resources Div.
J. Hren, T. H. Chaney, J. M. Norris, and C. J. O. Childress.
Available from USGS, OFSS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-574, 1985. 89 p, 13 fig, 21 tab, 7 ref.

Descriptors: *Water quality data, *Colorado, *Ohio, Criteria, Evaluation, Estimated costs, Cost-benefit analysis.

Pilot projects are being conducted in Colorado and Ohio to determine the extent to which existing water quality data, collected by different groups for various purposes and using different procedures, can be aggregated for use in addressing selected water quality questions of regional and national scope. The project has been divided into three phases; this report presents the results of the first phase that characterizes current water quality data collection activities in Colorado and Ohio, including costs of sample analysis, and identifies those data potentially applicable and readily available for addressing selected water quality questions of regional and national scope. An estimated $63 million was spent during 1984 in the two States for only the laboratory analysis of water quality samples. For many agencies, total program costs are believed to be more than twice the laboratory costs. About four times more samples were reported for Ohio than for Colorado. Water quality data collection programs were tested against a set of five screening criteria. In Colorado, 34 percent of all samples met all five criteria; whereas, in Ohio, 5 percent of all samples met all five criteria. In Colorado, analyses from 114,300 samples (34 percent of the total), and in Ohio, analyses from 57,000 samples (5 percent of the total) potentially are applicable and readily available for addressing water quality questions of regional and national scope. These samples represent about $8 million in estimated laboratory costs. (USGS)
W88-03087

IOWA GROUNDWATER MONITORING PROGRAM,
Geological Survey, Iowa City, IA. Water Resources Div.
M. G. Detroy.
Available from USGS, OFSS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-815, 1985. 34 p, 8 fig, 10 tab, 7 ref.

Descriptors: *Water quality, *Iowa, *Monitoring, *Hydrologic data, *Groundwater monitoring, Groundwater, Groundwater quality, Aquifers, Monitoring networks, Pollutants, Data collection, Monitoring strategy.

A groundwater quality monitoring network has been designed to collect data to describe the long-term chemical quality of major bedrock and Quaternary aquifer systems in Iowa. The network was designed because of data needs expressed by several State and Federal agencies. Most of the groundwater quality monitoring in the State has been directed at compliance or ambient monitoring of municipal water supplies. Some site specific monitoring has occurred. More recently several special studies or research monitoring activities have been completed or begun. The monitoring program utilizes a strategy which includes a low frequency and sparse distribution of samples from Cambrian-Ordovician, Mississippi-Pennsylvania, Silurian-Devonian, and Dakota aquifers. A larger density and greater frequency of samples will be obtained from shallow bedrock wells and from wells penetrating Quaternary aquifers such as alluvial, buried-channel and other drift aquifers. From more than 1200 candidate wells, 200 samples will be collected and analyzed annually. Analyses will be made for common anions and cations, trace metals, nutrients, radionuclides and some samples will be analysed for priority pollutants and pesticides. (USGS)
W88-03094

HYDROLOGIC RECONNAISSANCE AND SUMMARY OF EXISTING DATA ON SURFACE AND GROUNDWATER RESOURCES IN THE MISSOURI RIVER VALLEY IN WOODBURY AND MONONA COUNTIES, IOWA, 1985,
Geological Survey, Iowa City, IA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03129

WATER QUALITY DATA FOR THE GROUNDWATER NETWORK IN EASTERN BROWARD COUNTY, FLORIDA, 1983-1984,
Geological Survey, Miami, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03133

WATER QUALITY MONITORING STRATEGIES,
In-Situ, Inc., Lakewood, CO.
T. D. Steele.
Hydrological Sciences Journal HSJODN, Vol. 32,

No. 2, p 207-213, June 1987. 1 fig, 1 tab, 4 ref.

Descriptors: *Monitoring, *Network design, *Water quality, Design strategies, Information systems, Data collection, Data interpretation.

Four rhetorical questions regarding water quality monitoring which are paramount in formulating water quality network-design strategies were addressed. They were: (1) why, (2) how, (3) for whom are the data collected, and (4) how monitoring-program effectiveness is evaluated in considering future information needs. Aspects of these rhetorical issues were discussed, along with some recommended guidelines for setting of goals and objectives, specifying network-design functions, identifying information users, and anticipating future monitoring perspectives. The focus was on topics relevant to deliberations resulting from technical papers presented at the Symposium on Monitoring to Detect Changes in Water Quality Series, Budapest, July 1986. (Author's abstract)
W88-03278

SPATIAL VARIABILITY OF INFILTRATION RATES ON A SEMIARID SEEDED RANGELAND,
Utah State Univ., Logan. Coll. of Natural Resources.
For primary bibliographic entry see Field 2G.
W88-03281

CONCEPTUAL GROUNDWATER-QUALITY MONITORING NETWORK FOR SAN FERNANDO VALLEY, CALIFORNIA,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
J. G. Setmire.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4128, 1985. 49 p, 8 fig, 6 plates, 9 tab, 8 ref.

Descriptors: *Network design, *Geohydrology, *Monitoring, *Water pollution sources, *San Fernando Valley, *California, Land use, Water quality, Maps.

A conceptual groundwater-quality monitoring network was developed for San Fernando Valley to provide the California State Water Resources Control Board with an integrated, basinwide control system to monitor the quality of groundwater. The geology, occurrence and movement of groundwater, land use, background water quality, and potential sources of pollution were described and then considered in designing the conceptual monitoring network. The network was designed to monitor major known and potential point and nonpoint sources of groundwater contamination over time. The network is composed of 291 sites where wells are needed to define the groundwater quality. The ideal network includes four specific-purpose networks to monitor (1) ambient water quality, (2) nonpoint sources of pollution, (3) point sources of pollution, and (4) line sources of pollution. (USGS)
W88-03318

COST EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
R. A. Herbert, and D. D. Carlson.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4044, 1985. 59 p, 14 fig, 15 tab, 20 ref.

Descriptors: *Hydrologic data collections, *Cost-benefit analysis, *Surface-water records, *Louisiana, *Stream-gaging program, Stream gages, Surface-water data, Continuous stream flow data, Gaging stations, Flow-routing model.

This report documents the results of a study of the cost effectiveness of the stream-gaging program in Louisiana. Data uses and funding sources were identified for the 68 continuous-record stream gages currently (1984) in operation with a budget of $408,700. Three stream gages have uses specific to a short-term study with no need for continued data collection beyond the study. The remaining 65 stations should be maintained in the program for the foreseeable future. In addition to the current operation of continuous-record stations, a number of wells, flood-profile gages, crest-stage gages, and stage stations, are serviced on the continuous-record station routes; thus, increasing the current budget to $423,000. The average standard error of estimate for data collected at the stations is 34.6%. Standard errors computed in this study are one measure of streamflow errors, and can be used as guidelines in comparing the effectiveness of alternative networks. By using the routes and number of measurements prescribed by the 'Traveling Hydrographer Program,' the standard error could be reduced to 31.5% with the current budget of $423,000. If the gaging resources are redistributed, the 34.6% overall level of accuracy at the 68 continuous-record sites and the servicing of the additional wells or gages could be maintained with a budget of approximately $410,000. (USGS)
W88-03323

COST EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
H. L. Shindel, and W. P. Bartlett.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4072, 1986. 109 p, 17 fig, 14 tab, 14 ref.

Descriptors: *Network design, *Gaging stations, *Alternative planning, *Cost analysis, *Ohio, Budget, Economic efficiency, Regression analysis, Optimization.

Data uses and funding sources are identified for 107 continuous stream gages currently being operated by the U.S. Geological Survey in Ohio with a budget of $682,000; this budget includes field work for other projects and excludes stations operated for and by the Miami Conservancy District. No stream gages were identified as having insufficient reason to continue their operation; nor were any stations identified as having uses specific only for short-term studies. The average standard error of estimation of streamflow records is 29.2%. The overall level of accuracy of the 107 sites could not be maintained with a smaller budget. A minimum of $679,000 is required to operate the 107-gage program; a budget less than this does not permit proper service and maintenance of the gages and recorders. At the minimum budget, the average standard error is 31.1%. The maximum budget analyzed was $1,280,000, which resulted in an average standard error of 11.1%. Gaps in the gaging program have been identified by other agencies that cooperate in the program. It is suggested that these gaps be remedied as funds can be made available. (USGS)
W88-03342

CONNECTICUT OBSERVATION WELLS - GUIDELINES FOR NETWORK MODIFICATION,
Geological Survey, Hartford, CT. Water Resources Div.
R. L. Melvin.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4079, 1986. 24 p, 6 fig, 3 tab, 10 ref.

Descriptors: *Groundwater storage, *Groundwater levels, *Observation wells, *Network design, *Connecticut, Network evaluation.

The U.S. Geological Survey and Connecticut Department of Environmental Protection are developing a baseline observation well network to assess the present status of groundwater storage and relate it to long-term conditions and to describe and characterize natural changes in groundwater storage in relation to climatic variations, topography, and hydrogeologic setting. An evaluation of the present network of 31 observation wells indicates it is not representative of climatic areas or major hydrologic units in the State. Several wells provide equivalent information and six can be discontinued. Network modifications, including deletion of some existing wells and the addition of 50 to 60 new observation wells are needed to meet network objectives. Fourteen existing wells that have long-term records should be retained as a basis for historical comparisons. (USGS)
W88-03347

WATER-RESOURCES DATA NETWORK EVALUATION FOR MONTEREY COUNTY, CALIFORNIA--PHASE 1: SOUTH COUNTY,
Geological Survey, Sacramento, CA. Water Resources Div.
P. Showalter, and S. H. Hoffard.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4045, 1986. 102 p, 28 fig, 15 tab, 26 ref.

Descriptors: *Water resources data, *Network design, *California, Monterey County, Gaging stations, Statistical studies, Cost-benefit analysis.

An evaluation made of rainfall, surface water, groundwater, and water quality monitoring networks in Salinas River basin in southern Monterey County, California, proposed all long-term rain gages be continued for extending short-term records and suggested the installation of two additional recording gages. Eight new storage rain gages were suggested at midaltitudes of east and west sides of Salinas Valley where few data are available. The evaluation revealed some short-term gaging stations could be discontinued because of good regression relations between them and the long-term stations Arroyo Seco near Soledad. Of 16 stations selected for the proposed network, 4 are new recording stations, 6 are new nonrecording streamflow and water quality sampling sites, 5 are existing stations, and the last is a station operated from 1969 to 1976; also included are water quality sampling stations on Lakes Nacimiento and San Antonio. The proposed groundwater network was developed from information on geology, geohydrology, and groundwater quality, high priority objectives for groundwater network, and consideration for providing good areal coverage of levels and water quality. Of 145 sites selected, 86 are existing monitoring wells. (USGS)
W88-03356

INDEX OF CURRENT WATER-RESOURCES ACTIVITIES IN OHIO, 1985,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03365

USE AND AVAILABILITY OF CONTINUOUS STREAMFLOW RECORDS IN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
R. L. Gold, and L. P. Denis.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-572, 1985. 44 p, 3 fig, 2 tab, 5 ref.

Descriptors: *Streamflow data, *New Mexico, *Hydrologic data collections, Stream gages, Telemetry, Funding, Network analysis.

The use and availability of data collected at streamflow gaging stations in New Mexico is documented as the first phase of a three phase study of the cost-effectiveness of the stream gaging program. Presently, 143 continuous gaging stations are operated. Data collected at most gaging stations have multiple uses. Many stations are operated under the terms of eight legal compacts and two court decrees. These data provide the basis for distribution of irrigation water and operation of dams. Data from six stations are used for forecasting flood conditions. Water quality data are collected at many of the stations, ten of which have been designated as part of a national network of water quality data monitoring and two under the benchmark program. Data useful in the defining regional hydrology have been collected at a majority of the stations. All stations presently (1984) have sufficient justification for continued operations. (USGS)
W88-03377

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN ARKANSAS--FISCAL YEARS 1982 AND 1983,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03378

EVALUATION OF THE U.S. GEOLOGICAL SURVEY'S GAGING-STATION NETWORK IN ILLINOIS,
Geological Survey, Urbana, IL. Water Resources Div.
D. M. Mades, and K. A. Oberg.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 86-4072, 1986. 88 p, 6 fig, 13 tab, 26 ref.

Descriptors: *Network design, *Networks, *Stage-discharge relations, *Stream gages, *Streamflow, *Regional analysis, *Illinois, Error analysis, Rivers, Statistics, Data use, Kalman Filter, Data accuracy, Relative worth.

Data collected at 97 of the 176 gaging stations operated in Illinois during 1983 were used to describe rainfall-runoff processes, to monitor and forecast floods, and to monitor and regulate lake levels, discharge from reservoirs, or discharge of navigable streams. Stream-gaging stations on the Illinois River at Havana, East Branch Du Page River, and interior streams of the Mississippi River floodplain; peak-flow stations on small watersheds; and stage-only stations upstream from unsafe high-hazard dams should be considered for inclusion in future stream-gaging programs. The accuracy of regression models for peak-flow and 1-day mean flood-volume characteristics would not be considerably improved if the density of gaging stations and length of record at those gaging stations are increased. Model error masks tradeoffs between accuracy, density, and record length. The large number of streamflow records presently available is sufficient for fairly accurately determining most streamflow characteristics. The accuracy of streamflow records reported for stream gaging stations and peak-flow stations varies widely. The accuracy of streamflow records for 12 stream-gaging stations and 11 peak-flow stations is substantially less than the accuracy of records for the other 143 gaging stations considered. Based on an evaluation of relative worth, 26 gaging stations are candidates for some type of action if budgetary limitations so demand. A candidate stream-gaging stations could be operated during only part of a year, converted to a peak-flow station, or discontinued. Candidate peak-flow stations should be discontinued. (USGS)
W88-03429

COST-EFFECTIVENESS OF THE STREAM-GAGING PROGRAM IN THE HAWAII DISTRICT,
Geological Survey, Honolulu, HI. Water Resources Div.
I. Matsuoka.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4126, 1985. 76 p, 6 fig, 10 tab, 16 ref.

Descriptors: *Cost effectiveness, *Streamflow data, *Stream gages, *Hawaii, Economic aspects, Information transfer, Data collection programs, Oahu.

This project documents the results of a study of the cost-effectiveness of the stream-gaging program in the Hawaii District. The stream gages in the District were divided into two groups, the State of Hawaii and the Other Pacific Areas. Data uses and funding sources were identified for the 124 continuous stream gages currently being operated in the Hawaii District with a budget of $570,620. All the stream-gages were identified as having sufficient reason to continue their operation and they should be maintained in the program for the foreseeable future. (USGS)
W88-03445

7B. Data Acquisition

ANALYTICAL INSTRUMENTATION FOR CONTROL OF OZONATION SYSTEMS,
Societe Degremont, Rueil-Malmaison (France).
For primary bibliographic entry see Field 5F.
W88-02510

OVERVIEW OF METHODS FOR GROUND WATER INVESTIGATIONS,
Water Research Centre, Medmenham (England). Medmenham Lab.
For primary bibliographic entry see Field 2F.
W88-02543

METHODS FOR THE ASSESSMENT OF GROUND WATER POLLUTION POTENTIAL,
National Center for Ground Water Research, Norman, OK.
For primary bibliographic entry see Field 7A.
W88-02545

SUBSURFACE CHARACTERIZATION IN RELATION TO GROUND WATER POLLUTION,
Water Research Centre, Medmenham (England). Medmenham Lab.
For primary bibliographic entry see Field 5B.
W88-02548

MICROBIOLOGICAL CHARACTERIZATION OF SUBSURFACE ENVIRONMENTS,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 5A.
W88-02551

REGIONAL APPROACH TO GROUND WATER INVESTIGATIONS,
Oklahoma State Univ., Stillwater.
For primary bibliographic entry see Field 2F.
W88-02552

MICROPROCESSORS IN OPERATIONAL HYDROLOGY.
Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geneva, Switzerland, September 4-5, 1984. D. Reidel Publishing Company, Dordrecht, The Netherlands, 1986. 250 p.

Descriptors: *Microprocessors, *Hydrology, *Electronic equipment, *Data acquisition, *Microcomputers*Data storage and retrieval, *Data collections, *Computers, Conferences, Remote sensing, Instrumentation, Data transmission, Hydrologic models.

This book contains the papers presented at the Technical Conference on the Use of Microprocesors and Microcomputers in Operational Hyudrology, held in Geneva, 4-5 September 1984. The conference was organized by the World Meteorological Organization during the seventh session of the WMO Commission for Hydrology. During the last few years, the availability of cheap reliable micro-electronic devices, such as microprocessors and solid state memories, has led to their incorporation in measuring instruments for use in many fields, including operational hydrology. Characteristics of these devices such as low cost, low power consumption, high reliability, and tolertion of a wide range of environmental conditions make them particularly suited to applications in operational hydrology. Operational hydrological instruments have to be capable of working unattended for long periods, usually in remote sites, far from main electricity supplies. Until recently only the simplest mechanical recorders, driven by clockwork, were considered suitable for these applications, but a number of water resources agencies have now undertaken field trials leading to operational applications of microprocessor or microcomputer based instrumentation. In addition to the direct use of microprocessors in instrumentation and data transmission systems, low cost microcomputers are used to make computing power more widely available for purposes such as primary data processing in field offices or for dedicated applications such as on-line real time forecasting systems. The introduction of microcomputers will cause changes in operational procedures and require training of staff at all levels. (See W88-02618 thru W88-02639) (Lantz-PTT)
W88-02617

APPLICATION OF MICROCOMPUTER TECHNOLOGY TO OPERATIONAL HYDROLOGY IN CANADA,
Inland Waters Directorate, Ottawa (Ontario). Hydrometric Methods Section.
K. Wiebe, B. E. Goodison, and W. I. Pugsley.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 1-23, 8 fig, 1 tab, 13 ref.

Descriptors: *Microcomputers, *Canada, *Hydrology, *Data acquisition, *Data storage and retrieval, *Data collections, Instrumentation, Flow profiles, Remote sensing, Satellite technology, Electronic equipment, Meteorology.

Canadian operational hydrology has already reaped benefits from the use of microprocessor-controlled instrumentation to measure discharge under extremely difficult and rapidly varying flow conditions. At unattended remote sites, data collection platforms (DCPs) in conjunction with satellite telemetry provide data that in frequency, format and timeliness are compatible with current water management data needs. Both of these types of microprocessor-controlled instruments are discussed in detail with special emphasis on application, impact on the operation, and action taken to assure reliability. DCPs capable of collecting data from up to 16 sensors with a full range of signal outputs such as analog voltages, contact closure pulses, and parallel as well as serial digital output provide the opportunity to conduct experiments on the practicality of collecting data from hydrometric and meteorological sensors. The results of these experiments and the implications of operating a data acquisition network for more than one purpose are reviewed. (See also W88-02617) (Lantz-PTT)
W88-02618

MICROPROGRAM RECORDING OF HYDROLOGICAL DATA ON READ-ONLY MEMORY,
Office de la Recherche Scientifique et Technique Outre-Mer, Cayenne (French Guiana).
J. M. Fritsch, and P. Maillach.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 25-37, 3 fig.

Descriptors: *Data storage and retrieval, *Data collections, *Computer programs, *Hydrologic data, *Microcomputers, *Data acquisition, Read Only Memory, Microprocessors, CHLOE, OEDIPE, Hydrologic systems.

This paper describes two systems designed to meet the following objectives: (1) To provide data acquisition on a machine-readable medium by means of electronic processesing, thus eliminating the manual or asisted processing of graphic recordings which has always been a difficult area in hydrological studies; (2) To improve data collection realiability. Graphic recorders are very sensitive to environmental characteristics and many devices and components, such as clockwork mechanisms, paper, styluses, pens, etc., are likely to be adversely affected; (3) To store significant parameters only. While access to a programmable microprocessor enables the sensors to be scanned almost constantly, the storage command is only triggered if the parameter variation in question differs significantly from the most recently stored data; and (4) To reduce costs. The cost of precision engineered and clockwork sensors and data acquisition control

systems, which are only manufactured in limited numbers, can only increase in the current economic climate. The systems are: (1) the CHLOE hydrological processor (Centrale HydroLogique ORSTOM-ELSYDE) using silicon sensors and a sophisticated processing unit; and (2) OEDIPE (Organe d'Enregistrement Digital de l'Information PluviometriqE) raingauge, with mechanical sensors (tilting bucket) and a simple processing unit The OEDIPE system is available at a modest price and is suitable for use by non-skilled personnel. (See also W88-02617) (Lantz-PTT)
W88-02619

APPLICATIONS OF MICROPROCESSORS AND COMPUTERS FOR SOME HYDROLOGICAL OBSERVATIONS,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
L. Palos, and O. Starosolszky.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 39-47, 4 fig, 1 ref.

Descriptors: *Microprocessors, *Computers, *Hydrology, *Data acquisition, Sampling, Hydrologic systems.

Applications for microprocessors are outlined briefly in this paper, demonstrating that microprocessors and pocket calculators open new opportunities in the domain of hydrological observations for: sampling at intervals adjustable without limitation, adjusting the duration of sampling, averaging the samples taken, storage and display of the values desired, primary processing of data at the site or station, thus merging the processes of observation and processing. A process has thus been initiated, which may bring about radical and rapid changes in the hydrological data acquisition system and in the hydrological observation network. (See also W88-02617) (Lantz-PTT)
W88-02620

RELIABILITY OF MICROPROCESSOR-BASED FLOOD-WARNING SYSTEMS; CHOICE OF ARCHITECTURE AND DEGRADED MODE PROCEDURES; FRENCH EXPERIENCE,
P. A. Roche.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 49-57.

Descriptors: *Microprocessors, *Flood forecasting, *Warning systems, *France, *Data acquisition, *Microcomputers, Automation, Computers, Computer programs.

The French Government has launched a large-scale modernization program for its flood warning systems with three main thrusts: automation of real-time data collection, updating and improvement of flood forecasting methods, and reorganization of the public information system. It is discussed how, and within what limits, the introduction of the microprocessor and microcomputer in the data collection system for flood warnings has increased the reliability of the whole sequence of operations. The development of higher-speed flood warning systems is essentially linked to the improvement of their reliability. The introduction of microprocessors to replace both electronic hardware with hard-wired logic and electro-mechanical systems has made for considerable gains in all areas: reliability, ease of maintenance, adaptability, safeguards and operational checks. The central sites are equipped both with management computers for automatic driving of the interrogation cycles, and computers which provide simulations of forecasting methods, elaborate consistency checks and numerous calculations supplying information to assist alarm decision taking, which had been, until now, totally inaccessible in real-time. Today's software should be designed for managing situations of degraded mode operation, since such situations are always possible. (See also W88-02617) (Lantz-PTT)
W88-02621

REAL-TIME RAINFALL DATA ACQUISITION SYSTEM,
Royal Observatory (Hong Kong).
B. Y. Lee.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 59-68, 2 fig, 2 plates, 4 ref.

Descriptors: *Meteorlogical data collection, *Rainfall, *Data acquisition, *Microprocessors, *Automation, Computers, Electronic equipment, Rainfall data acquisition system, RDAS.

The availability of relatively inexpensive microprocessors simplifies considerably the electronic design of hardware. Electronic hardware conventionally built to accomplish some of the design functions is replaceable by microprocessor software. During the testing and implementation stages of the RDAS, efforts have been saved by simply making changes in the software instead of having to redesign the electronic circuitry. In places where dedicated telephone lines are cost-prohibitive, it is possible to make modifications, mainly software, in the microprocessor transmitter and receiver controllers in order to accomodate the use of an ordinary dialling circuit as the communication link. The essential parts of the central control system of the RDAS were implemented in November 1983 and eight rain gages became operational in December 1983. Apart from some minor modifications in the software during initial operation, there have been no major faults of any sort. Work is in progress to incorporate into the microprocessor transmitter controller at the field site an automatic rainfall recorder which stores rainfall data on solid-state Erasable Programmable Read-Only Memory (EPROM). The power supply to the equipment at field site will be backed up by batteries. These measures will ensure that rainfall data will not be lost in case of telephone line failures and power stoppages at the field site. (See also W88-02617) (Lantz-PTT)
W88-02622

DEVELOPMENT AND SUPPORT OF MICROPROCESSOR TECHNOLOGY FOR HYDROLOGIC DATA COLLECTION BY THE U.S. GEOLOGICAL SURVEY,
Geological Survey, Reston, VA. Water Resources Div.
R. W. Paulson.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 69-79, 1 fig, 1 tab, 4 ref.

Descriptors: *Hydrologic data collections, *Microprocessors, *Hydrologic data, *Data acquisition, *Computer programs, *Computers, Data collections, Geological Survey, Adaptable Hydrologic Data Acquisition System, AHDAS, Costs, Instrumentation, Electronic equipment.

The U.S. Geological Survey's Adaptable Hydrologic Data Acquisition System program (AHDAS), from the time it was identified that the existing dta collection system needed upgrade, until it is scheduled to begin field deployment, will take approximately seven years. Throughout this period, the Survey has, and will be, conducting associated studies and reviews of ancillary issues. These include the policy and legal implications of making the transition to a magnetic recording medium from a punched paper-tape recording medium. Studies are being made of moving from a fixed time interval of data recording to event-driven sampling schemes. Proper interfacing of AHDAS with the distributed information system network will be addressed so that the two major elements of the data system can harmoniously be integrated. Intensive studies are being conducted to assure that the Hydrologic Instrumentation Facility (HIF), which is the Survey's principal hydrological instrumentational support facility, is properly equipped and staffed to support the maintenance, repair, and procurement of AHDAS units, subassemblies and components. (See also W88-02617) (Lantz-PTT)
W88-02623

TELEMETERING HYDROMETEOROLOGICAL NETWORK IN MENDOZA, ARGENTINA: ONE YEAR OF EXPERIMENTS AND RESEARCH,
Andean Regional Centre of INCYTH, Mendoza (Argentina).
P. C. Fernandez, O. Roby, L. Fornero, and J. Maza.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 81-90, 7 fig, 2 tab, 11 ref.

Descriptors: *Hydrometeorology, *Telemetry, *Mendoza, *Argentina, *Data acquisition, *Meteorological data collection, Remote sensing, *Automation, Rainfall, Forecasting, Rainfall-runoff relationships, Model studies, Hydrology.

The development of increasingly precise automatic data-acquisition equipment at decreasing cost has had a decisive impact on the instrumentation in catchments and on the practical possibility of having operational real-time systems for use either as flood warning networks or for more efficient water-resource management. These facts are part of the reason why the Andean Regional Centre of INCYTH is currently setting up a telemetering network on a pilot area of 600 sq km to the west of the city of Mendoza in the foothills of the Andean Cordillera. From the point of view of hydrological research, the need is to supplement the network of 12 stations in the pilot area and install one or two stations to the north in order to obtain reports on conditions on the edges of the nuclei centered over that zone. The present system of recording rainfall or level data at the central station takes a minimum of three minutes and must be reduced at least to one minute in order to have an undistorted determination of both rainfall and flows. Another two flow measuring stations must be set up to analyze the response of the larger catchments which are totally or partially affected by storms. In order to obtain a hydrological alerts system, the following is required: to supplement the network, taking it into areas at present not covered both in the rural and suburban area to the east of the stations now in service and even into the urban area; to duplicate the data-collection, processing and archiving equipment of the central station; and to set up an automatic power generator in order to avoid disruption of service during power cuts. The development of rainfall and discharge forecasting technology using computerized radar or sectorized weather satellite images (eg., real-time) calls for networks of this kind for their calibration and verification. (See also W88-02617) (Lantz-PTT)
W88-02624

LARGE SCALE ENVIRONMENTAL DATA COLLECTION - DISSEMINATION SYSTEM USING A MINICOMPUTER NETWORK,
Central Inst. for Management and Informatics, Bucharest (Romania).
I. Dumitrascu.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 91-96.

Descriptors: *Data acquisition, *Hydrologica data collections, *Information systems, *Data storage

and retrieval, *Meteorological data collection, *Minicomputers, *Computer programs, *Networks, Environmental policy, Hydrometeorology, Hydrology, Automation.

In Romania, environmental parameters such as: barometric pressure, air temperature, humidity, wind speed and direction, precipitation, solar radiation, snowfall, radioactivity, pollution, and water levels are measured by human operators or by automatic stations with associated sensors, transmission and processing of the data obtained, resulting in minicomputer oriented data collection systems. To collect environmental data from a large geographical area, many such acquisition systems must be connected in a hierarchical, flexible and highly reliable system structure. The purpose of the system is to collect, process and transmit enviornmental data in real-time to end-users to be used in meteorology, hydrology, flood forecasting and warning, pollution control, river management, agriculture and transport. The application software runs on CORAL or INDEPENDENT Romanian minicomputers, but also on any of the PDP-11 minicomputers (DEC) using RSX-11M VS.2 operating system and DECNET-11 m minicomputer network software, with small modifications required by any device drivers. The task for data acquisition from the automatic stations can be modified to be used for other type of stations. (See also W88-02617) (Lantz-PTT)
W88-02625

INTELLIGENT MEASURING STATION OPERATIONAL FOR FLOOD WARNING IN BELGIUM,
Vrije Univ., Brussels (Belgium). Lab. of Hydrology.
A. Beken, J. Marivoet, and L. Deriemaker.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 97-112, 9 fig, 1 tab, 6 ref.

Descriptors: *Flood warning, *Belgium, *Measuring instruments, *Data acquisition, *Hydrologic data collections, *Data processing, *Computers, Forecasting, Rainfall intensity, Hydrology, Hygrometers, Solarimeters, Wind velocity, Wind direction, Temperture, Rain gages.

Hydrology has evolved into an important engineering science which is the basis of large scale studies and expensive hydraulic engineering works with important social-economic and environmental impact. This evolution has been enhanced by the use of computers, which allows for vast quantities of field measurements to be treated and analyzed. Computer models are now being used for all kinds of hydrological applications, while in earlier days one had to be satisfied with oversimplified empirical formulae. The Laboratory of Hydrology of the Free University Brussels, in cooperation with the Center for Statistics and Operations Research and the Laboratory of Informatics, has developed various research projects dealing with quantitative and qualitative aspects of water. Attention was first drawn to the study of the automatic control of flood reservoirs. It was necessary to develop 'intelligent measuring stations' (IMS) to pursue this goal. The first prototype of the IMS has been operational since March 1983 and controls the meteorological station at the campus Oefenplein of the Free University of Brussels. The following instruments are collecting data on a 10-min time base: 2 types of raingages, 1 air-theromometer, 1 hygrometer, 1 barometer, 1 solarimeter, 1 wind speed meter, and 1 wind direction meter. These data are stored on floppy discs for about one month. Afterwards they are transferred to the mainframe computer for further processing. The reliability of this system during the period 1.1.83-1.6.84 was about 80%. The missing data were the result of surcharge of the Minicomputer and the fact that the IMS was a prototype. The nominal total hardware cost of this prototype, exclusive the measuring instruments, the telemetry system and the minicomputer, can be rated at about 60,000 BF. (See also W88-02617) (Lantz-PTT)
W88-02626

MICROTIDEDA,
Ministry of Works and Development, Wellington (New Zealand).
M. E. U. Taylor, S. M. Thompson, and M. W. Rodgers.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 127-139, 6 fig.

Descriptors: *Hydrologic data collections, *MicroTIDEDA, *Data acquisition, *Data processing, *Computer programs, Hydrologic data, Databases, Statistical studies, Data interpretation.

MicroTIDEDA is a computer system for processing time-dependent data, particularly hydrological data. The software, like other data base systems can be used to collect, edit, store, display and analyze the information it is given. MicroTIDEDA uses programming techniques which allow numerical data to be filed in the minimum amount of disk space and retrieved at high speed. This has enabled the transfer to microcomputers of software which originally required a mainframe computer to run. MicrotTIDEDA deals with data that are naturally recorded as a time sequence. Examples are streamflows, rainfall, air temperatures and electric power generation. The lack of an elaborate data structure in such data sequence allows simple processing methods, and only the large quantity of data justifies the use of an electronic computer. The microTIDEDA program accepts data from a variety of automatic recording instruments. The data is stored in a form designed to facilitate checking, correcting and analysis, and a comprehensive set of aids is provided for these purposes. When microTIDEDA is manipulating data, it can apply a combination of linear and nonlinear transformations. The linear transformation allows the application of scale and additive factors, while the nonlinear transformation is performed by applying a user-defined function to the data. This function is entered as a series of discrete values, and for hydrological data allows the representation of state-to-discharge rating curves. Features available in microTIDEDA fall into five categories: (1) processes which provide general statistical summaries; (2) Processes which allow data entry; (3) Processes which deal with the correction, storage and deletion of data, the manipulation of files and batches, and the efficient use of space; (4) A process which lets the user write his own data analysis software using a simple programming language; and (5) Several processes which control a software's operating environment. (See also W88-02617) (Lantz-PTT)
W88-02628

EXPERIENCE OF MICROPROCESSORS IN THE NATIONAL AUTOMATIC DATA ACQUISITION SYSTEM IN SWEDEN,
Sveriges Meteorologiska och Hydrologiska Inst., Norrkoeping.
T. Hovberg, and J. Nilsson.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 141-153, 6 fig, 8 ref.

Descriptors: *Data acquisition, *Hydrologic data collections, *meteorologic data collection, *Computers, *Computer programs, *Automation, *Microcomputers, *Sweden, Hydrologic data, Data storage and retrieval, Hydrologic data collections, Costs.

The Swedish Meteorological and Hydrological Institute started to use microprocessors in 1977. Today approximately 60 field stations (ADAT) equipped with microprocessors are in operation and another 40 field stations will be taken into operation in the next 2-3 years. Experiences indicate that complicated data collection projects can be solved in a relatively simple way by using microprocessors and software instead of only hardware. The technique is so powerful that the limitation is rather the lack of creative imagination than the capability of the computer. It is an enormous advantage to have the maintenance of both the hardware and the software in the same organization. This means that the data acquisition system must be built up in a modular way, from the sensor to data storage. Development and maintenance of software is expensive. Costs can be reduced by using the same type of microprocessor in so many applications as possible and to build up a library of calculation modules. By combining the modules, a suitable program for a new station can be produced with a minimum of costs. It is preferable to use only one central station to collect data. The need of real-time data in local areas, for instance airfields, pilot houses, road authorities, mountain cable-car stations, ect, is satisfied by locally placed displays. Updating is done every time the central station makes a data collection or from the displays if needed. (See also W88-02617) (Lantz-PTT)
W88-02629

SHORT TERM SNOWMELT FLOW FORECAST SYSTEM,
For primary bibliographic entry see Field 2B.
W88-02630

COMPREHENSIVE HYDROLOGICAL DATA SYSTEM,
Ministry of Works and Development, Wellington (New Zealand).
M. E. U. Taylor, and S. M. Thompson.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 195-203, 5 fig.

Descriptors: *Hydrologic data, *Data acquisition, *New Zealand, *Hydrologic data collections, *Telemetry, Data evaluation, Data storage and retrieval, Floods, Forecasting, Rainfall, Water quality.

The water resource is very important to the New Zealand economy. Floods severe enough to cause damage to property occur somewhere in New Zealand about once a year on average. Accurate water resource data is therefore given a high priority by the water resource management authority. In the mide 1970's a scheme for telemetering much of this data was proposed. Feasibility studies showed that in addition to improved flood warning and forecasting, substantial operational savings could result in hydrological data collection. Many of the key hydrological and rainfall measuring stations are located in inaccessible country requiring access by helicopter or a several-day trip using four wheel drive vehicles. The overall system provides accurate measurement, data transfer, quality assurance, data handling and storage, and applications software (including flood forecasting). Sensors for stage, rainfall and water quality, radio telemetry equipment, and data handling aspects of the system are discussed. Whereas earlier all data editing involved handling both by a centralized data processing system and by later manual editing by field staff, nowadays the data entry EDP is all carried out by field staff. Time savings amount to weeks and sometimes months, and editing is now done while events are fresh in staffs' memories. When the telemetry and integration of the whole system is complete in four years time, the automted data quality assurance procedures will assist greatly in standardizing the quality of data produced by the 22 different national and local agencies involved. The New Zealand Treasury estimates the return from operational savings alone would be 24% pa. The savings resulting from better flood forecasts are an additional bonus. (See also W88-02617) (Lantz-PTT)
W88-02634

EXPERIENCE ON THE USE OF AN AUTOMATIC DATA COLLECTION AND TRANSMISSION SYSTEM IN A HYDROLOGICAL RESEARCH BASIN,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
F. Koch, and H. Lang.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 205-212, 3 fig, 3 tab.

Descriptors: *Data acquisition, *Hydrologic data, *Hydrology, *Automation, *Hydrologic data collections, *Telemetry, Measuring instruments, Data transmission, Data storage and retrieval, Hydrometeorology, Precipitation, Temperature, Lysimeters, Gamma radiation.

Instrumentation in the Rietholzbach catchment (3.18 sq km, 690-950 m) in Switzerland was started in 1975. It was decided to use an automatic data collection and transmission system to have a continuous control of the measuring system and of the sensors used in order: (a) to reduce time for maintenance; (b) to reduce loss of records in case of failures in the observation system; and (c) to have the data available at any time for processing in the operational real-time forecasting and in the analysis of the actual hydrological processes. The data collection system measures at the following components: discharge gauging station Rietholzbach, including a pneumatic gauge for analogue and digital recording; and Hydrometeorological station Buel, including different sensors for airtemperature, air humidity, soil temperature, precipitation, radiation components, lysimeter weight and outflow (3.14 sq m surface area, 2.30 m soil profile), gamma radiation device for snow water euivalent and soil moisture (also used for class-A-pan water level), meltwater lysimeter. The operation of this system over a period of nine years has confirmed its irretrievability to offering a continuous control of the system, including the sensors, and by providing realtime information about the hydrological events. The great benefit therefore lies obviously in the automatic transmission of the data. At the same time the observation data are available for real time operational orecasting purposes. The importance of maintenance by trained personnel is to be emphasized. Cost and benefit considerations are clearly on the side of benefit, if manpower is taken into account, which would be necessary without teletransmission to check the recording systems in the field and to collect data necessary for daily operational purposes. (See also W88-02617) (Lantz-PTT)
W88-02635

COMPUTERIZED SUPERVISION AND CONTROL OF DUJAILAH IRRIGATION PROJECT,
Baghdad Univ. (Iraq). Coll. of Engineering.
For primary bibliographic entry see Field 3F.
W88-02636

SYNCHRONOUS FLUORESCENCE SPECTRA OF NATURAL WATERS: TRACING SOURCES OF DISSOLVED ORGANIC MATTER,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
S. E. Cabaniss, and M. S. Shuman.
Marine Chemistry MRCHBD, Vol. 21, No. 1, p 37-50, May 1987. 7 fig, 2 tab, 20 ref. NSF Grant OCE-85-12069.

Descriptors: *Fluorescence, *Measuring instruments, *Spectral analysis, *Tracers, *Analytical methods, *Natural waters, *Rivers, Ions, Metals, Regression analysis.

The fluorescence of North Carolina river samples observed simultaneously by scanning excitation and emission wavelengths at a fixed wavelength difference of 25 nm produced synchronous spectra characteristic of each sample's dissolved organic matter. Examination of the spectra of two river samples for pH, copper, magnesium and ferric iron effects revealed that the metals affect only fluorescence intensity whereas pH alters both intensity and spectral shape. Mixtures of up to four rivers were resolved using linear regression analysis and the synchronous spectrum of each component in the mixture. A similar analysis of field samples may be useful for tracing the source, circulation and mixing of dissolved organic matter in coastal waters, lakes or estuaries. (Author's abstract)
W88-02676

REMOTE SENSING OF SUBMERGED AQUATIC VEGETATION IN LOWER CHESAPEAKE BAY: A COMPARISON OF LANDSAT MSS TO TM IMAGERY,
Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, ME.
S. G. Ackleson, and V. Klemas.
Remote Sensing of Environment RESEA7, Vol. 22, No. 2, p 235-248, July 1987. 3 fig, 5 tab, 18 ref. NASA Contract NAS5-27580 and NASA Grant NAGW0374.

Descriptors: *Remote sensing, *Satellite technology, *Submerged plants, Algorithms, Water depth, Model studies, Canopy, Comparison studies, Chesapeake Bay.

Landsat Multispectral Scanner and Thematic Mapper imagery, obtained simultaneously over Guinea Marsh, VA, were analyzed and compared for their ability to detect submerged aquatic vegetation (SAV). An unsupervised clustering algorithm was applied to each image, where the input classification parameters are defined as functions of apparent sensor noise. Class confidence and accuracy were computed for all water areas by comparing the classified images, pixel-by-pixel, to rasterized SAV distributions derived from color aerial photography. To illustrate the effect of water depth upon classification error, areas of depth greater than 1.9 m (6 ft) were masked and class confidence and accuracy recalculated. A single-scattering radiative transfer model is used to illustrate how percent canopy cover and water depth affect the volume reflectance from a water column containing SAV. For a submerged canopy that is morphologically and optically similar to Zostera marina inhabiting Lower Chesapeake Bay, dense canopies may be isolated by masking optically deep water. For less dense canopies, the effect of increasing water depth is to increase the apparent percent crown cover, which may result in classification error. (Author's abstract)
W88-02678

CALIBRATION OF THEMATIC MAPPER THERMAL DATA FOR WATER SURFACE TEMPERATURE MAPPING: CASE STUDY ON THE GREAT LAKES,
Wisconsin Univ., Madison. Inst. for Environmental Studies.
R. G. Lathrop, and T. M. Lillesand.
Remote Sensing of Environment RESEA7, Vol. 22, No. 2, p 297-307, July 1987. 6 fig, 3 tab, 8 ref. Federal Grant NA800AA-D-00086, Project 144-U824.

Descriptors: *Model studies, *Remote sensing, *Satellite technology, *Mapping, *Water temperature, *Great Lakes, Infrared imagery, Prediction, Calibrations.

The potential utility of Landsat-5 Thematic Mapper (TM) thermal IR (Band 6) data for measuring and mapping surface water temperatures of the Great Lakes is analyzed. Two contiguous TM scenes were collected on 18 July 1984 over the Green Bay-North Central Lake Michigan and Milwaukee-South Central Lake Michigan regions, respectively. The TM thermal IR data were empirically calibrated using surface reference data. The regression model so developed, was then used to map surface temperature over the entire TM coverage area. Surface reference data points not used in the original calibration were used to test the predictive capability of the model over a wider geographic area. As part of the Landsat Image Data Quality Analysis effort (LIDQA), Bartolucci et al. have investigated the absolute calibration of TM thermal IR data. Application of these calibration equations to this data set verified their accuracy, resulting in a root mean square error of less than 1 C. (Author's abstract)
W88-02679

INTERACTION BETWEEN A NATURAL SNOWFALL AND A COOLING TOWER PLUME: AN EXPERIMENTAL STUDY WITH A MILLIMETRIC DOPPLER RADAR,
Clermont-Ferrand-2 Univ., Lannemezan (France). Center of Atmospheric Research.
For primary bibliographic entry see Field 6G.
W88-02686

ION-CHROMATOGRAPHIC TRACE ANALYSIS OF AMPEROMETRICALLY DETECTABLE ANIONS IN WATER (IONEN-CHROMATOGRAPHISCHE SPURENANALYSE AMPEROMETRISCH DETEKTIERBARER ANIONEN IN WASSERN),
Stuttgart Univ. (Germany, F.R.). Inst. fuer Lebensmittelchemie.
For primary bibliographic entry see Field 5A.
W88-02724

PRECONCENTRATION OF SILVER(I), GOLD(III) AND PALLADIUM(II) IN WATER SAMPLES WITH 2,2'-DIPYRIDYL-3-((4-AMINO-5-MERCAPTO)-1,2,4-TRIAZOLYL)HYDRAZONE SUPPORTED ON SILICA GEL,
Thessaloniki Univ., Salonika (Greece). Lab. of Analytical Chemistry.
For primary bibliographic entry see Field 5A.
W88-02725

APPLICATION OF THE TRITIUM INTERFACE METHOD FOR DETERMINING RECHARGE RATES TO UNCONFINED DRIFT AQUIFERS: I. HOMOGENEOUS CASE,
Michigan State Univ., East Lansing. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2F.
W88-02767

MEMBRANE FILTER METHOD FOR THE ENUMERATION OF AQUATIC AMMONIFIERS,
Colorado State Univ., Fort Collins. Dept. of Microbiology and Environmental Health.
For primary bibliographic entry see Field 5B.
W88-02831

RELATION BETWEEN MEASURED RADAR REFLECTIVITY AND SURFACE RAINFALL,
P. M. Austin.
Monthly Weather Review, MRWEAB, Vol. 115, No. 5, p 1053-1070, May 1987. 23 fig, 7 tab, 27 ref.

Descriptors: *Reflectivity, *Measuring instruments, *Radar, *Rainfall, Rainfall patterns, Weather, Storms, Remote sensing, Comparison studies.

A number of physical factors that influence the relation between measured radar reflectivity and surface rainfall are considered both theoretically and through detailed comparisons of radar and raingauge measurements. These factors include natural differences in raindrop-size distributions, enhancement of radar reflectivity by presence of hailstones or melting snow, diminution of reflectivity by downdrafts, and low-level changes in rainfall rate caused by accretion or evaporation. Results of 374 comparisons in twenty storms, which cover a wide variety of synoptic situations and rainfall patterns, are presented. Magnitudes of the effects of the different factors are estimated, and storm types where they are likely to be significant are pointed out. Also, some ways of compensating for the observed effects are suggested. (Author's abstract)
W88-02839

ELECTROMETRIC DETERMINATION OF THE PH OF ATMOSPHERIC PRECIPITATION,

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
For primary bibliographic entry see Field 5A.
W88-02854

RESEARCH IN ENVIRONMENTAL POLLUTION: III. DETERMINATION OF NITROFEN IN MAIN- AND RHINE-FISH(UNTERSUCHUNGEN ZUR UMWELTBELASTUNG: III. BESTIMMUNG VON NITROFEN IN MAIN- UND RHEINFISHEN),
Hessische Landwirtschaftliche Versuchsanstalt, Darmstadt (Germany, F.R.).
For primary bibliographic entry see Field 5B.
W88-02856

ION AND TEMPERATURE DEPENDENCE OF ELECTRICAL CONDUCTANCE FOR NATURAL WATERS,
Minnesota Univ., Duluth. Dept. of Chemistry.
J. A. Sorensen, and G. E. Glass.
Analytical Chemistry ANCHAM, Vol. 59, No. 13, p 1594-1597, July 1987. 4 fig, 2 tab, 18 ref. EPA Cooperative Agreement CR809412.

Descriptors: *Analytical methods, *Measuring instruments, *Mathematical equations, *Water analysis, *Conductivity, *Solutions, *Conductance, Ions, Lakes, Water quality.

Four empirical equations describing the temperature dependence of electrical conductance of aqueous solutions are compared for the case of single electrolytes. The best method uses a modified Walden product where the log of the ratio between the conductances at two temperatures is assumed to be proportional to the log of the corresponding ratio of viscosities, that is, log (X sub t1/X sub t2) = K log (eta sub t2/eta sub t1). A basis for predicting the constant of proportionality for mixed systems given the ion concentrations is proposed and the dependence of ionic strength effects and ion association is discussed. The value of K may also be estimated from the hydrogen ion concentration (in micromoles per liter) where K = 0.941 - 0.00639(H+) as found by regression of data for 692 lakes. A case study of time trend data for lakes is presented. (Author's abstract)
W88-02857

DESIGN AND EVALUATION OF AN ELECTROCHEMICAL SENSOR FOR DETERMINATION OF DISSOLVED OXYGEN IN WATER,
Universidad Nacional de San Luis (Argentina). Facultad de Quimica, Bioquimica y Farmacia.
S. Quintar de Guzman, O. M. Baudino, and V. A. Cortinez.
Talanta TLNTA2, Vol. 34, No. 6, p 551-554, June 1987. 4 fig, 2 tab, 15 ref.

Descriptors: *Analytical methods, *Measuring instruments, *Dissolved oxygen, *Electrochemical sensors, *Design criteria, Performance evaluation, Voltammetry, Field tests, Costs, Cathodes, Sensitivity.

A voltammetric cell with a graphite-paste cathode and silver-wire anode was designed for dissolved oxygen determinations in water. Its most important features were evaluated in laboratory and field studies. Several advantages such as higher sensitivity, wider linear response interval, negligible interference due to carbon dioxide, and shorter response time, besides its low cost and simple construction, were found when it was compared with sensors having a platinum cathode. (Author's abstract)
W88-02862

METHOD FOR MEASURING ENRICHED LEVELS OF DEUTERIUM IN SOIL WATER,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 2G.
W88-02891

SATELLITE SUPPORT TO THE SIERRA COOPERATIVE PILOT PROJECT: 1979/80 AND 1980/81,
Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
J. L. Behunek, and T. H. Vonder Haar.
Interim Progress Report to Bureau of Reclamation, Office of Atmospheric Resources Management, September 1984. 74 p, 23 fig, 5 tab, 7 ref, 2 append, Contract No. 9-07-85-V0025.

Descriptors: *Remote sensing, *Satellite technology, *Weather modification, *Precipitation, *Meteorological data collection, Data collections, Sierra Cooperative Pilot Project, Sierra Nevada Range, Clouds, Orographic precipitation.

Digital satellite data were collected and analyzed in support of the 1979/80 and 1980/81 Sierra Cooperative Pilot Project field seasons. Data from the visible and IR spectral channels encompassed the Sierra Nevada Range and surrounding regions. All satellite data were carefully navigated to allow the accurate location of geographic points within the images. Those data were permanently archived on magnetic tape. Remote surface meteorological station data also were collected. Analyses of the digital satellite data were performed in statistical and case study modes. Cloud top temperature statistics that were computed according to Precipitation Echo Type (PET) diagnosed a mean cloud top temperature for each PET and examined the natural variability of the PETs. Those statistics suggest a possible modification potential for the C1, C2 and NE PETs. A case study of the cloud top temperature-precipitation relation showed that satellite data could provide a precipitation covariate, especially when cellular convection was excluded. Another case study demonstrated that PETs can be identified from the satellite data, resulting in an increased area over which they can be observed. Cirrus clouds were a constraint for both case studies. (Author's abstract)
W88-02943

A TWO-DIMENSIONAL GRAPHING PROGRAM FOR THE TEKTRONIX 4050-SERIES GRAPHICS COMPUTERS,
Geological Survey, Denver, CO. Water Resources Div.
K. L. Kipp.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4087, 1983. 47 p, 11 fig, 1 tab.

Descriptors: *Computer programs, *Graphical methods, *Graph-plotting programs, Data processing, Tektronix, PLOT2D.

A refined, two-dimensional graph-plotting program was developed for use on Tektronix 4050-series graphics computers. Important features of this program include: any combination of logarithmic and linear axes, optional automatic scaling and numbering of the axes, multiple-curve plots, character or drawn symbol-point plotting, optional cartridge-tape data input and plot-format storage, optional spline fitting for smooth curves, and built-in data-editing options. The program is run while the Tektronix is not connected to any large auxiliary computer, although data from files on an auxiliary computer easily can be transferred to data-cartridge for later plotting. The user is led through the plot-construction process by a series of questions and requests for data input. Five example plots are presented to illustrate program capability and the sequence of program operation. (USGS)
W88-03002

PHRQINPT-AN INTERACTIVE COMPUTER PROGRAM FOR CONSTRUCTING INPUT DATA SETS TO THE GEOCHEMICAL SIMULATION PROGRAM PHREEQE,
Geological Survey, Reston, VA. Water Resources Div.
G. W. Fleming, and L. N. Plummer.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4236, 1983. 135 p, 2 ref.

Descriptors: *Computer programs, *Geochemistry, *Interactive computer techniques, *Simulation, *PHREEQE, *FORTRAN program.

PHRQINPT is a FORTRAN 77 program which facilitates formulation of the input data file to PHREEQE (Parkhurst, Thorstenson, and Plummer, 1980). PHRQINPT runs interactively and contains many features to help the user construct the input data set. This report describes these features and gives instructions on the use and implementation of PHRQINPT. A listing of the program and the two accompanying data sets are given in the attachments, along with two examples. (USGS)
W88-03003

THEORY AND OPERATION MANUAL FOR THE AUTOPIPET, SEMI-AUTOMATIC PIPET WITHDRAWAL APPARATUS,
Geological Survey, Minneapolis, MN. Water Resources Div.
J. F. Beverage.
Federal Interagency Sedimentation Project, St. Anthony Falls Hydraulics Laboratory, Minneapolis, Minnesota, Report Z, A Study of Methods Used in Measurement and Analysis of Sediment Loads in Streams, 1982. 71 p, 13 fig, 7 ref.

Descriptors: *Fluvial sediments, *Soil analysis, *Particle size, *Pipet analysis, Silt, Fall velocity, Clay.

The Autopipet is a semi-automatic withdrawal apparatus which obtains unattended the six scheduled withdrawals (for 62, 31, 16, 8, 4, and 2 micrometers) of the pipet particle-size procedure. A fixelevation, 12-depth siphon sampling scheme is used instead of mechanically lowering the pipet to a predetermined depth for each withdrawal. An optical water-level sensor stops the siphon when the correct volume is obtained. A wasted withdrawal precedes each of the scheduled subsamples to flush the siphon line and to fill the line with a suspension of nearly the same concentration as the subsequent sample. A brief description of particle settling theory and of the compromises made during the design are given. Operational procedures, circuit descriptions, and a troubleshooting guide are given in appendices. (USGS)
W88-03007

DEVELOPMENT OF A BAG-TYPE SUSPENDED-SEDIMENT SAMPLER,
Geological Survey, Minneapolis, MN. Water Resources Div.
J. J. Szalona.
Federal Interagency Sedimentation Project, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, Report Y, A Study of Method Used in Measurement and Analysis of Sediment Loads in Streams, July, 1982. 32 p, 11 fig, 7 ref.

Descriptors: *Sediment, *Sediment sampler, *Suspended sediments, Bag-type sediment sampler, Collapsible-bag sediment sampler.

Standard U.S. series suspended-sediment samplers have a limited depth range determined by the size of the container, the nozzle diameter, and the stream velocity. To circumvent this limitation, a collapsible-bag sampler was developed. A special sampler (D-77) which has a 3-liter capacity was adapted to use a thin plastic food-storage bag. A solenoid-actuated valve was developed to provide point-integration capability as well as the ability to depth-integrate deep rivers segmentally. The system was tested in a laboratory flume, measuring sample volume collected during various sampling periods, and at various flow rates. The average nozzle intake velocity was calculated and divided by the measured stream velocity where the sample had been collected. This ratio, the relative sampling rate, was in the desired range of 1.00 + or - 0.15 for stream velocities above 0.47 m/s. Maximum stream velocity attainable in the flume was 2 m/s. The effect of water temperature on sampling rate was also investigated. (USGS)
W88-03008

EVALUATION OF TECHNIQUES FOR MAPPING LAND AND CROPS IRRIGATED BY CENTER PIVOTS FROM COMPUTER-ENHANCED LANDSAT IMAGERY IN PART OF THE JAMES RIVER BASIN NEAR HURON, SOUTH DAKOTA,
Geological Survey, Lakewood, CO. Water Resources Div.
K. E. Kolm.
Available from USGS, OFSS, Available from USGS, OFFSS, Box 25425, Denver, CO 80225 USGS Water-Resources Investigations Report 85-4021, 1985. 24 p, 4 fig, 3 tab, 31 ref.

Descriptors: *Landsat Imagery, *Remote sensing, *Irrigation practices, *James River basin, *South Dakota, Water use.

The objective of this study was to evaluate remote sensing techniques for mapping irrigated crop types and acreages in part of the James River basin of South Dakota, using Landsat imagery. The results demonstrated that a subtraction (band 7 minus band 4) method was best for identifying the location of cropland irrigated by groundwater. Two separate principal-spectral-components analyses (analysis of the second principal-spectral component and the simultaneous analysis of the first three principal-spectral components) were best for identifying the crop type and estimating crop acreages. However, only 50 percent of the irrigated lands could be identified and only 79 percent of these could be classified accurately by crop type. Therefore, a 39 percent overall accuracy was achieved in irrigated crop-type identification. (USGS)
W88-03014

INVESTIGATION OF THE NEED FOR DISCHARGE ADJUSTMENTS FOR UNSTEADY FLOW AT SELECTED GAGING STATIONS ON TENNESSEE STREAMS,
Geological Survey, Memphis, TN. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03026

INTERLABORATORY COMPARABILITIES, BIAS, AND PRECISION FOR FOUR LABORATORIES MEASURING CONSTITUENTS IN PRECIPITATION, NOVEMBER 1982-AUGUST 1983,
Geological Survey, Lakewood, CO. Water Resources Div.
M. H. Brooks, L. J. Schroder, and B. A. Malo.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4313, 1985. 14 p, 7 tab, 7 ref.

Descriptors: *Water quality, *Laboratory standards, *Water analysis, *Statistical methods, *Laboratories, *Chemical analysis, Precipitation (Atmospheric), Rainwater, Bias, Comparability, Precision.

Four laboratories were evaluated in their analysis of identical natural and simulated precipitation water samples. Interlaboratory comparability was evaluated using analysis of variance coupled with Duncan's multiple range test, and linear-regression models describing the relations between individual laboratory analytical results for natural precipitation samples. Results of the statistical analyses indicate that certain pairs of laboratories produce different results when analyzing identical samples. Analyte bias for each laboratory was examined using analysis of variance coupled with Duncan's multiple range test on data produced by the laboratories from the analysis of identical simulated precipitation samples. Bias for a given analyte produced by a single laboratory has been indicated when the laboratory mean for that analyte is shown to be significantly different from the mean for the most-probable analyte concentrations in the simulated precipitation samples. Ion-chromatographic methods for the determination of chloride, nitrate, and sulfate have been compared with the colorimetric methods that were also in use during the study period. Comparisons were made using analysis of variance coupled with Duncan's multiple range test for means produced by the two methods. Analyte precision for each laboratory has been estimated by calculating a pooled variance for each analyte. Analyte estimated precisions have been compared using F-tests and differences in analyte precisions for laboratory pairs have been reported. (USGS)
W88-03046

SMALL-AREA SNOW SURVEYS ON THE NORTHERN PLAINS OF NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03057

OPERATING MANUAL FOR THE DIGITAL DATA-COLLECTION SYSTEM FOR FLOW CONTROL STRUCTURES,
Geological Survey, NSTL Station, MS. Water Resources Div.
J. I. Rorabaugh, and W. L. Rapp.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-691, 1986. 39 p, 8 fig, 2 tab.

Descriptors: *Instrumentation, *Stream gaging, *Flow-control structures, Dams, Locks, Gates.

This manual was written to help the user operate and maintain the digital data collection system for flow control structures. The system is used to measure daily discharge through river control dams. These dams commonly have tainter gates which are raised and lowered to keep the upper pool level relatively constant as the river flow changes. In order to measure the flow through such a structure, the positions of the tainter gates and the headwater and tailwater elevations must be known. From these data, the flow through the structure can be calculated. A typical digital data collection system is shown. Digitizing devices are mounted on the hoisting mechanism of each gate, as well as at the headwater and tailwater gages. Data from these digitizers are then routed by electrical cables to a central console where they are displayed and recorded on paper tape. If the dam has locks, a pressure-sensitive switch located in the lock activates a counter in the console which keeps track of the number of times the lock is drained and filled. (USGS)
W88-03067

WATER RESOURCES ACTIVITIES IN NEW YORK 1985-86,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03073

GEOPHYSICAL WELL LOG DATA FOR STUDY OF WATER FLOW IN FRACTURES NEAR MIRROR LAKE, NEW HAMPSHIRE,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03083

HYDROLOGIC DATA FROM ROAN CREEK AND PARACHUTE CREEK BASINS, NORTHWESTERN COLORADO,
Geological Survey, Grand Junction, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03092

DATA FOR FOUR GEOLOGIC TEST HOLES IN THE SACRAMENTO VALLEY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
C. F. Berkstresser, J. J. French, and M. E. Schaal.
Available from USGS, OFSS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-488, 1985. 110 p, 7 fig, 5 tab, 12 ref.

Descriptors: *Test holes, *Geologic logging, *Geophysical logging, *Neutron logging, *Borehole geophysics, *California, Gamma-ray logging, Formation density, Geophysics, Central Valley, Sacramento Valley, Solano County, Yolo County.

The report provides geological and geophysical data for four of seven test holes drilled as a part of the Central Valley Aquifer Project, which is part of the Regional Aquifer Systems Analysis. The holes were drilled with a rotary well drilling machine to depths of 900 feet in the southwestern part of the Sacramento Valley in Solano and Yolo Counties. Geologic data for each well include lithology, texture, color, character of the contact, sorting, rounding, and cementation, determined from cuttings, cores, and sidewall covers. Fifty cores, 3 feet long, were obtained from each hole, and from eight to fourteen sidewall cores were collected. Geophysical data include a dual-induction log, spherically focused log (SFL), compensated neutron-formation density log, gamma-ray log, and a caliper log. These data are presented in four tables and on four plates. (USGS)
W88-03096

EXTENSION OF THE UNSTEADY ONE-DIMENSIONAL OPEN-CHANNEL FLOW EQUATIONS FOR FLOW SIMULATION IN MEANDERING CHANNELS WITH FLOOD PLAINS,
Geological Survey, Bay Saint Louis, MS. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03120

COMPARISON OF TWO STREAM-DISCHARGE RECORD RECONSTRUCTION TECHNIQUES FOR EIGHT GAGING STATIONS IN MAINE,
Geological Survey, Augusta, ME. Water Resources Div.
R. A. Fontaine.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. Supt Doc, USGPO, Wash, DC 20402. In: USGS Water-Supply Paper 2290, 1986. p 107-112, 1 fig, 4 tab, 1 ref.

Descriptors: *Correlation, *Statistical methods, *Maine, Missing records, Record reconstruction, Analysis, Streamflow measurement, Accuracy, Statistics, Stream gaging.

An analysis of two commonly used stream-discharge record-reconstruction methods shows that the standard error of estimate for a missing record can be improved using independent observations of stage. The accuracy of a missing record reconstructed using both techniques was evaluated at eight stream gages in Maine where independent observations of stage and correlative stream gage data from other sites are available. The average standard error for a missing record reconstructed with flow data from other stream gages is 52.9%. The average standard error for a missing record reconstructed with independent observations of stage at the same site is 15.0%. The average standard error of published streamflow data in Maine is currently 17.7 percent. This average standard error could be reduced io approximately 13.0 percent if independent observations of stage are available to estimate the missing record. (USGS)
W88-03121

COMPARISON OF VELOCITY-AREA INTERPOLATION METHODS FOR COMPUTING OPEN-CHANNEL DISCHARGE,
Geological Survey, Atlanta, GA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03124

PRELIMINARY EVALUATION OF A DISCHARGE COMPUTATION TECHNIQUE THAT USES A SMALL NUMBER OF VELOCITY OBSERVATIONS,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03125

OPERATING MANUAL FOR THE MINI-SERVO-CONTROL TESTER,
Geological Survey, NSTL Station, MS. Water Resources Div.
W. L. Rapp.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-690, 1986. 7 p, 2 fig.

Descriptors: *Instrumentation, *Stream gages, *Servo controls, *Manometers, Streamgaging.

Ever since the implementation of servo-control units (regular and minimodels) with manometers at U. S. Geological Survey streamflow stations, the need for an effective and efficient servo-control unit tester has been paramount among field personnel. In numerous cases, servo-control unit failures were blamed on battery failures and vice versa. There was no valid instrument to definitively identify cause of failure, let alone properly diagnose the servo-control/manometer system. In 1983, two servo-control unit testers were developed and fabricated. One was mechanical in fabrication, operation, and serviceability; the other was electronic. The testers were extensively used and evaluated in Maine, Ohio, Kansas, and Louisiana under a wide range of environmental conditions. The consensus to integrate the best aspects of both testers into one instrument allowed the Survey to finally solve its long-time need for an effective, efficient servo-control unit tester. (USGS)
W88-03134

CURRENT WATER RESOURCES ACTIVITIES IN ALABAMA, FISCAL YEAR 1986,
Geological Survey, Tuscaloosa, AL. Water Resources Div.
L. J. Slack, and E. A. Meadows.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-131, 1986. 88 p, 4 fig, 5 tab.

Descriptors: *Water quality, *Surface water, *Groundwater, *Hydrologic data, *Water data collection, *Alabama, Water resources.

The purpose of this report is to describe the current (as of 1986) water resources activities of the U.S. Geological Survey in Alabama. The responsibilities and objectives of the Survey; organization of the Alabama District; sources of funding; current projects; hydrologic data program; and a selected bibliography of hydrologic reports are presented. Water resources projects are undertaken usually at the request of and with partial funding from another agency, provided: they are high priority problems and generally identified to fall within the mission of the Water Resources Division and they are consistent with the Program Management Plan developed by the Water Resources Division in Alabama to meet the long range plan for hydrologic data in the State. (USGS)
W88-03140

THERMAL DEVICE FOR AIRCRAFT MEASUREMENT OF THE SOLID WATER CONTENT OF CLOUDS,
Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. of Atmospheric Research.
W. D. King, and D. E. Turvey.
Journal of Atmospheric and Oceanic Technology, Vol. 3, No. 3, p 356-362, September 1986. 11 fig, 10 ref, append.

Descriptors: *Measuring instruments, *Cloud solid water, *Data acquisition, Clouds, Temperature probe, Ice, Aircraft measurements, Measuring instrument accuracy, Mathematical equations, Cloud physics, Calibrations.

A constant temperature probe for the measurement of solid water content of clouds is described. The probe is operated at a temperature of approximately 25 C, and is designed to collect and melt ice particles that impact in an open half-cylinder, the amount of power supplied to the probe being related to the solid water content through its dimensions, etc. Comparisons in a small wind tunnel with values derived from weighings of oil-coated slides suggest that the probe is accurate to about 50%, while data from two different aircraft indicate that it performs reliably under flight conditions. (Author's abstract)
W88-03282

NEAR-INFRARED EXTINCTION IN RAIN MEASURED USING A SINGLE DETECTOR SYSTEM,
University of Western Ontario, London. Faculty of Engineering Science.
F. J. Nedvidek, C. W. Schneider, Z. Kucerovsky, and E. Brannen.
Journal of Atmospheric and Oceanic Technology, Vol. 3, No. 3, p 391-399, September 1986. 5 fig, 1 tab, 33 ref.

Descriptors: *Measuring instruments, *Rainfall, *Data acquisition, *Rain gages, *Infrared extinction, Optical instruments, Comparison studies, Rainfall rate, Mathematical equations, Mathematical studies, Rain, Precipitation.

The performance and operation of an optical device to measure extinction due to rainfall over a 100 m sample path accurately is described. A collimated beam from an infrared light-emitting diode operating at 0.94 micrometers is used as a sensing beam. A PIN diode detector receives reference and sample signals alternately in a switch arrangement using a beam splitter and mirrored chopper wheel. Demultiplexing and phase sensitive detection are used to separate and demodulate the sample and reference signals. The experimental results are in agreement with theoretical predictions and theoretical results obtained for rainfall rates up to 90 mm/hour. Extinction calculations based on the recent theoretical treatment of Ulbrich and Atlas produced a best fit to the experimental results. A single detector, although more complex than a two-detector system which provides adequate accuracy for short-term measurements, yields a greater degree of long-term stability. Therefore, the described single detector system is better for long-term precipitation monitoring. It also has the advantage of being portable and is battery-operated so it can be used for mobile or remote location precipitation measurement. (Wood-PTT)
W88-03283

VINDICATION OF THE TWOMEY-TYPE CLOUD CONDENSATION NUCLEUS COUNTER,
Missouri Univ.-Rolla. Dept. of Mechanical and Aerospace Engineering.
D. J. Alofs, and Y. T. Tue.
Journal of Atmospheric and Oceanic Technology, Vol. 3, No. 3, p 481-486, September 1986. 6 fig, 3 tab, 10 ref. NSF Grant ATM79-24326.

Descriptors: *Data acquisition, *Twomey-type counter, *Measuring instruments, *Nucleation, *Cloud condensation nuclei, *Clouds, Cloud liquid water, Detection limits, Mathematical equations, Simulation, Numerical simulation, Supersaturation, Mathematical analysis.

The performance of the Twomey-type cloud condensation nucleus (CCN) counter is evaluated by a numerical simulation and found to be better than that predicted in an earlier study. Due to lack of data on CCN spectra at low supersaturations, the earlier study used extrapolations that subsequent measurements show are unrealistic for atmospheric CCN. The present study indicates that if the instrument has a 0.5 micrometer radius detector limit, the count is accurate to within 15% for operating supersaturations above 0.1 % and for typical atmospheric aerosols. (Author's abstract)
W88-03286

IMPROVED HIGH-RESOLUTION RAINGAGE,
Auckland Univ. (New Zealand). Dept. of Physics.
J. G. Hosking, C. D. Stow, S. G. Bradley, and W. R. Gray.
Journal of Atmospheric and Oceanic Technology, Vol. 3, No. 3, p 536-541, September 1986. 10 fig, 14 ref.

Descriptors: *Measuring instruments, *Rain gages, *Rainfall intensity, *Rainfall, High-resolution rain gages, Design improvement, Rain, Gages, Design standards, Field tests.

Evaluation of an earlier rain gage based on counting drops formed on the tip of a small-diameter stainless-steel tube shows a defect due to resonant oscillation of the water column in the dropper unit. The defect causes nonlinearity in the drop rate-flow rate relationship, precluding useful integration of the gage output. An improved design is presented which eliminates this defect. Laboratory tests on the new design show linear performance over two orders of magnitude of rainfall intensity with time resolution of better than 5 seconds and accuracy limited by sampling errors. The new gage is also shown to perform well in field testing. (Author's abstract)
W88-03287

WATER-RESOURCES ACTIVITIES IN UTAH BY THE U.S. GEOLOGICAL SURVEY, JULY 1, 1985 TO JUNE 30, 1986,
Geological Survey, Salt Lake City, UT. Water Resources Div.
J. S. Gates, and S. L. Dragos.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-533, 1987. 60 p, 5 fig.

Descriptors: *Utah, *Data collections, *Hydrologic data, Water resources studies, Projects, Project planning.

Twenty-two studies of water resources in Utah were conducted by the U.S. Geological Survey from July 1, 1985, through June 30, 1986. Three of these studies were completed on or before June 30, 1986, and four were scheduled to be completed on September 30, 1986. Seventeen of these studies were in cooperation with Federal, State, county, or local agencies. Six additional studies are proposed to begin on July 1 or October 1, 1986 or April 1, 1987. The 28 current and proposed projects include 5 involved mainly with collection of data, 4 concerned with the hydrology of Utah's energy-resource areas, 3 focused on floods, 4 on surface water or surface water quality, 4 on groundwater in unconsolidated sediments, mostly in the basins of western Utah, 2 concerned with groundwater in consolidated rock in southeastern Utah, 5 focused on groundwater quality, and 1 on general water availability. (USGS)
W88-03302

TRAVELTIME AND LONGITUDINAL DISPERSION IN ILLINOIS STREAMS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03308

MEASUREMENTS OF SCOUR-DEPTH NEAR BRIDGE PIERS,
Geological Survey, Minneapolis, MN. Water Resources Div.
J. V. Skinner.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4106, 1986. 33 p, 13 fig, 2 tab, 35 ref.

Descriptors: *Bridge piers, *Bridge failures, *Scour, *Channel erosion, *Highways, Bridges, Piers.

River-bed scour is a major source of damage to bridge piers and bridge abutments. When scour depth exceeds design limits, the supporting material around the footings is washed away and the structure becomes unstable. Equations for predicting scour-depth show a significant lack of agreement so portable equipment for measuring scour is needed. An instrumented, unmanned boat was designed. It (a) can be launched and controlled from a bridge and (b) can be manuevered in flood flows that reach velocities of 15 ft/s. Calculations indicate the battery-powered propulsion system alone will weigh about 300 lb and that the craft must be

about 15-ft long. Because a free-running craft will be undesirably heavy and large, other methods of obtaining scour data are proposed. A tethered craft fitted with a controllable rudder and some methods of measuring scout at a point are presented for future study and development. (USGS)
W88-03337

CURRENT WATER RESOURCES ACTIVITIES IN ARKANSAS, 1984-85,
Geological Survey, Little Rock, AR. Water Resources Div.
B. L. Louthian, and E. E. Gann.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-554, 1985. 57 p, 7 fig, 2 tab.

Descriptors: *Hydrology, *Arkansas, Hydrologic data, Water use, Groundwater, Surface water, Water quality, Hydrologic studies.

This report describes water resources activities conducted by the Arkansas District of the U.S. Geological Survey, Water Resources Division, during fiscal years 1984 and 1985. Activities included surface water, groundwater, water quality, and water-use investigations. Twenty-five projects were funded during 1984 and 1985. For each project, a description of the project objectives, approach, plans and reports is included. Lists are included of reports completed during the period and of reports previously published by, or in conjunction with the Geological Survey. (USGS)
W88-03371

APPLICATION OF SEISMIC REFRACTION TECHNIQUES TO HYDROLOGIC STUDIES,
Geological Survey, Hartford, CT. Water Resources Div.
F. P. Haeni.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 84-746, 1986. 144 p, 56 illus, 8 tab, 125 ref.

Descriptors: *Geophysics, *Groundwater, *Seismic properties, *Seismic-refraction methods, *Surface geophysics, Aquifers, Water resources.

Seismic-refraction methods have been extensively used in petroleum, mineral, and engineering investigations and to some extent, for hydrologic applications during the past 30 years. Recent advances in equipment, sound sources, and computer-interpretation techniques make seismic-refraction methods a highly effective and economical means of obtaining subsurface data in hydrologic studies. Aquifers that can be defined by one or more high seismic-velocity surfaces, such as alluvial or glacial deposits in consolidated rock valleys, limestone or sandstone underlain by metamorphic or igneous rock, or saturated unconsolidated deposits overlain by unsaturated unconsolidated deposits, are ideally suited for applying seismic-refraction methods. These methods allow the economical collection of subsurface data and provide the basis for more efficient collection of subsurface data by test drilling or aquifer tests and results in improved hydrologic studies. This manual briefly reviews the basics of seismic refraction theory and principles. It emphasizes the use of this technique in hydrologic investigations and describes the planning, equipment, field procedures, and interpretation techniques needed for this type of study. Examples of the use of seismic refraction techniques in a wide variety of hydrologic studies are presented. (USGS)
W88-03399

DATA USES AND FUNDING OF THE STREAMFLOW-GAGING PROGRAM IN NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
G. L. Ryan.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-349, 1985. 29 p, 3 fig, 2 tab, 4 ref.

Descriptors: *Stream gages, *Streamflow, *North Dakota, *Data use, Economic aspects, Water resources data, Streamflow data, Funding.

This project documents the uses, funding, and availability of the streamflow data currently collected in North Dakota. Presently (1984), 94 streamflow-gaging stations are operated in North Dakota on a budget of $663,000. Station type, data uses, and funding sources are identified for each of the 94 stations. Data from all stations have multiple uses. All stations have sufficient justification for continuation, but five stations primarily are used in short-term research studies. Those five stations are scheduled to be discontinued at the end of the 1985 water year. (USGS)
W88-03416

7C. Evaluation, Processing and Publication

PRIMRY PROCESSING OF HYDROLOGICAL DATA ON MICROCOMPUTERS,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
K. Futaki, and Z. Vargay.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 113-125, 2 fig.

Descriptors: *Data processing, *Computers, *Hydrologic data, *Micromputers, *Computer programs, Training.

In the early Seventies, microcomputers, presented the following advantages vs. the 'classical' type of equipment: no need for air conditioned rooms, no need for specially trained staff, and easy installation in User's offices. However, these machines originally had some disadvantages as well: limited memory and storage capacity, and fairly long access time. These problems have almost disappeared as a result of constant improvement enabling microcomputers to solve more and more complex tasks. Recognition of the advantages of microcomputers has incited the Hydrological and Water Resources Department of the WMO to create, in collaboration with the Hungarian Research Centre of Water Resources/VITUKI/, a program package for the primary processing and storage of hydrological data using microcomputers. The Data Base Management System has been developed by VITUKI in the FORTRAN programming language. The program sequence has been adapted first to a TANDY TRS-80 Model-II, having TRSDOS operating system, and later converted for the standard CP/M operating system. The use of the sequence does not need special training; the programs are elaborated for technicians level. The installation of the sequence can be performed within 4 to 6 weeks including the training of the staff. (See also W88-02617) (Lantz-PTT)
W88-02627

MICROTIDEDA,
Ministry of Works and Development, Wellington (New Zealand).
For primary bibliographic entry see Field 7B.
W88-02628

FLOOD FORECASTING FOR A LARGER CATCHMENT USING RECORDS FOR SMALLER CATCHMENTS,
Ministry of Works and Development, Christchurch (New Zealand). Hydrology Centre.
For primary bibliographic entry see Field 2E.
W88-02632

USE OF MICROCOMPUTERS IN OPERATIONAL HYDROLOGY IN JAPAN,
Public Works Research Inst., Tsukuba (Japan).
For primary bibliographic entry see Field 2E.
W88-02633

COMPREHENSIVE HYDROLOGICAL DATA SYSTEM,
Ministry of Works and Development, Wellington (New Zealand).
For primary bibliographic entry see Field 7B.
W88-02634

APPLICATION OF MICROCOMPUTERS TO THE CALCULATION OF DESIGN FLOWS AND FLOOD CONTROL (MANAGEMENT OF SMALL, PARTIALLY URBANIZED CATCHMENTS),
Ecole Polytechnique Federale de Lausanne (Switzerland). Inst. de Genie Rural.
R. Gloor, and P. Wisner.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 223-232, 7 fig, 2 tab, 14 ref.

Descriptors: *Microcomputers, *Flood control, *Flow profiles, *Computer programs, *Computers, *Administration, *Design standards, *Computer models, Urban areas, Hydrology, Microprocessor, OTTHYMO, UBBHYD, NASHYD, KINROUTE, DUHYD, Runoff, Routing, Flood routing.

In the field of hydrology, microprocessors can and should serve at two levels: (1) the engineering firm, during the preparation of preliminary studies and detailed projects; and (2) the administrative level, when supervisory activities are required for complex projects, for the management and analysis of planning stages, and even for real time forecasting. Although engineering firms generally have in-depth knowledge of hydrology, such is not the case at the administrative level. A model made available to the 'supervisor', therefore must be simplified and must produce results which are compatible with the methods used by the 'designer', and must be easily accessible. Clarity and consistency are, therefore, essential elements. Among the vast numbers of hydrological models available on the market today, the OTTHYMO model (Ottawa Hydrologic Model) was chosen for this study. The OTTHYMO model is an expanded version of the HYMO model, and includes four new subroutines: URBHYD for urbanized areas; NASHYD for rural areas; KINROUTE for calculating flow in collectors; and DUHYD enables runoff on roads and in collectors to be considered separately in urban areas. The OTTHYMO model may be used for the preparation of overall plans or for detailed studies. The models and subroutines described in this paper for use on microcomputers are an invaluable tool. They function interactively and are very easy to use, both at the data input level as well as at the result analysis stage. Moreover, they have been used and verified on numerous occasions in Switzerland and Canada. (See also W88-02617) (Lantz-PTT)
W88-02637

HYDROLOGY AND DATA PROCESSING IN THE MEMBER STATES OF THE COMITE INTERAFRICAIN D'ETUDES HYDRAULIQUES (CIEH),
Comite Interafricain d'Etudes Hydrauliques, Ouagadougou (Burkina Faso).
C. Puech.
IN: Microprocessors in Operational Hydrology. Proceedings of the Technical Conference on the Use of Microprocessors and Microcomputers in Operational Hydrology, Geveva, Switzerland, September 4-5, 1984. D. Reidel Publishing Co., Dordrecht, The Netherlands, 1986. p 233-237, 2 fig.

Descriptors: *Data processing, *Comite Interafricain d'Etudes Hydrauliques, *Hydrologic data, *Computers, *Microcomputers, Statistical analysis, Mapping, Runoff, Model studies.

The CIEH (based in Ouagadougou, Burkina Faso) is situated roughly at the geographical center of its 13 Member States. It serves as a focal point for hydraulic studies in the various countries, either by centralizing and redistributing hydraulic information (the documentation center has 12,000 docu-

ments), or by carrying out or commissioning studies on hydraulics which are of interest to all or some of its Member States. The CIEH carries out some of the studies included in its program, but with respect to hydrology alone it has had to computerize its data processing for this work. Various program have been developed on microcomputers (in BASIC) for the following applications: statistics, data analysis; fitting statistical distributions used in hydrology; mapping, automatic plotting of stage curves; and runoff models. These applications have been developed for specific studies such as: the study of exceptional (24-hr) rainfalls in the various states; development of a new method for determining flood discharges in small basins in the region; automatic mapping of control measurements for the artificial rain experiment held in Ougadougou in 1983; calculations or areal reduction factors for rainfall and calculations of urban runoff; secondary processing of rainfall records in order to plot 'rainfall depth-duration-frequency' curves; etc., all of these applications being of a very distinctly scientific nature. Moreover, because of its role as advisor to the Member States, the CIEH is concerned with the computerization of the data processing services in the relatively new African States. It helps them chose the computer hardware or in developing software, such as programs for publishing the hydrological yearbooks for the Ministry of Rural Development of Burkina Faso. In collaboration with teh Ecole Inter-Etats d'Ingenieurs et de l'Equipement Rural (EIER, Ouagadougou), it has also held training courses on data processing to help the Member States master the relevant techniques. (See also W88-02617) (Lantz-PTT)
W88-02638

COMPUTATION OF DESIGN FLOOD LEVELS ON MICROCOMPUTERS,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
For primary bibliographic entry see Field 2E.
W88-02639

CASE STUDY TO ASSESS THE POTENTIAL FOR SALINE SOIL DEVELOPMENT DUE TO IRRIGATION,
Alberta Univ., Edmonton. Dept. of Geology.
For primary bibliographic entry see Field 2G.
W88-02764

TESTS OF ARMA MODEL FORMS FOR RAINFALL-RUNOFF MODELLING,
Queensland Water Resources Commission, Brisbane (Australia).
For primary bibliographic entry see Field 2A.
W88-02765

ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES,
Texas A and M Univ., College Station. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W88-02766

COMPARING A THREE-DIMENSIONAL AND A DUPUIT-FORCHHEIMER SOLUTION FOR A CIRCULAR RECHARGE AREA IN A CONFINED AQUIFER,
Indiana Univ., Bloomington. School of Public and Environmental Affairs.
For primary bibliographic entry see Field 5B.
W88-02769

TRANSFER OF HYDROLOGIC INFORMATION AMONG RIVER POINTS,
George Washington Univ., Washington, DC. International Water Resources Inst.
For primary bibliographic entry see Field 2E.
W88-02770

APPLICATION OF DISCRETE AUTOREGRESSIVE MOVING AVERAGE MODELS FOR ESTIMATION OF DAILY RUNOFF,
Ohio Univ., Athens. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W88-02771

TRANSFORMATIONS FOR IMPROVED CONVERGENCE OF DISTRIBUTIONS OF FLOOD MAXIMA TO A GUMBEL LIMIT,
Waikato Univ., Hamilton (New Zealand). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2E.
W88-02772

NOTE ON THE ANALYSIS OF SLUG TESTS,
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.
A. Dax.
Journal of Hydrology JHYDA7, Vol. 91, No. 1/2, p 153-177, May 15, 1987. 11 fig, 10 tab, 11 ref.

Descriptors: *Data interpretation, *Slug tests, *Aquifers, *Groundwater, *Aquifer testing, *Well testing, *Mathematical equations, Mathematical studies, Permeability coefficient, Wells, Field tests, Clogging.

A new method is suggested for analyzing the data of slug tests. The method is based on the observation that in many cases the buildup, H(t), decays exponentially. That is, H(t) = H sub 0 e to the (-lambda t) power, where lambda is a positive constant. It is shown that the measured value of lambda can be used to estimate K, the hydraulic conductivity of the aquifer in the close vicinity of the well. The proposed method is demonstrated on field data of several slug tests. The earlier explanation of exponential decay in slug tests employs a modified version of the Thiem equation, which is based on certain steady-flow assumptions. Now it is shown that the phenomenon is not limited to steady flow and that it is likely to occur under a wide range of conditions. The use of slug tests as a tool for monitoring the effects of clogging in small-diameter observation wells is introduced. (Author's abstract)
W88-02773

FIELD TEST OF A SIMPLE SOIL-WATER BALANCE MODEL FOR IRRIGATED AREAS,
Indian Agricultural Research Inst., New Delhi. Water Technology Center.
For primary bibliographic entry see Field 2G.
W88-02774

MODIFIED LINEAR PROGRAMMING GRADIENT METHOD FOR OPTIMAL DESIGN OF LOOPED WATER DISTRIBUTION NETWORKS,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Industrial Engineering and Management.
For primary bibliographic entry see Field 5F.
W88-02775

USE OF STOCHASTIC DYNAMIC PROGRAMMING FOR RESERVOIR MANAGEMENT,
California Univ., Los Angeles. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W88-02776

STOCHASTIC MODELING OF VERTICALLY AVERAGED CONCENTRATION UNCERTAINTY IN A PERFECTLY STRATIFIED AQUIFER,
Stanford Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W88-02777

GROUNDWATER GEOCHEMISTRY OF SHORT-TERM AQUIFER THERMAL ENERGY STORAGE TEST CYCLES,
Illinois State Water Survey Div., Champaign.
For primary bibliographic entry see Field 2F.
W88-02778

ACCURACY OF SEDIMENT DEPOSITION ESTIMATION,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W88-02779

PARAMETER ESTIMATION IN GROUNDWATER: CLASSICAL, BAYESIAN, AND DETERMINISTIC ASSUMPTIONS AND THEIR IMPACT ON MANAGEMENT POLICIES,
Wright State Univ., Dayton, OH.
For primary bibliographic entry see Field 4B.
W88-02780

NONLINEAR FLOOD ROUTING WITH MULTILINEAR MODELS,
California Univ., Berkeley. Energy and Resources Group.
For primary bibliographic entry see Field 2E.
W88-02782

DEVELOPMENT AND TESTING OF A WATER BALANCE MODEL FOR CLIMATE IMPACT ASSESSMENT: MODELING THE SACRAMENTO BASIN,
California Univ., Berkeley. Energy and Resources Group.
For primary bibliographic entry see Field 5C.
W88-02783

STOCHASTIC ANALYSIS OF CONTAMINANT TRANSPORT IN POROUS MEDIA: ANALYSIS OF A TWO-MEMBER RADIONUCLIDE CHAIN,
Sandia National Labs., Albuquerque, NM.
For primary bibliographic entry see Field 5B.
W88-02784

PERTURBATION BOUNDARY ELEMENT CODE FOR STEADY STATE GROUNDWATER FLOW IN HETEROGENEOUS AQUIFERS,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W88-02785

ESTIMATION OF BROOKS-COREY PARAMETERS FROM WATER RETENTION DATA,
Princeton Univ., NJ. Water Resources Program.
For primary bibliographic entry see Field 2G.
W88-02786

ANALYTICAL AND EXPERIMENTAL SOLUTIONS FOR DRAINAGE OF SLOPING LANDS WITH TIME-VARYING RECHARGE,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India).
For primary bibliographic entry see Field 2F.
W88-02787

FLOW EQUATIONS IN TERMS OF PIEZOMETER LEVELS FOR NONISOTHERMAL FLUID IN LOW-PERMEABILITY POROUS MEDIUM,
Rockwell International, Richland, WA. Rockwell Hanford Operations.
For primary bibliographic entry see Field 5E.
W88-02788

ENSO SIGNAL IN CONTINENTAL TEMPERATURE AND PRECIPITATION RECORDS,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 2B.
W88-02791

EFFICIENCY IN WATER ALLOCATION UNDER STOCHASTIC DEMAND,
California Univ., Santa Barbara.
For primary bibliographic entry see Field 6D.
W88-02800

PERCENTILE ESTIMATION FOR WATER QUALITY DATA,

WRC Engineering, Swindon (England).
For primary bibliographic entry see Field 5D.
W88-02829

WORLD CATALOGUE OF MAXIMUM OBSERVED FLOODS,
Office de la Recherche Scientifique et Technique Outre-Mer, Bondy (France).
J. A. Rodier, and M. Roche.
IAHS-AISH Publication No. 143, 1984. 378 p, 1 fig, 275 tab. Project No. A.2.7.2.

Descriptors: *Floods, *Historic floods, *Flood data, Precipitation, Annual floods, Flood basins, Flood peak, Rivers, Streamflow, Hydrology.

Information on exceptionally large floods is presented for 1400 stations in 95 countries. Table I gives parameters necessary for understanding the hydrology of the area and the formation of floods. This includes basin area, slope, soil, cover regime, mean precipitation, and mean discharge. Table II lists the maximum flood and the second and third largest floods, if available. For many of the floods information is given about the procedures used for flood estimating and about the precipitation causing the flood. The maximum flood listed for the United States is 70,000 cu m/sec on the Mississippi River at Arkansas City, Arkansas, in June 1927. Table III lists the chronological series of yearly maxima for the countries and subdivisions. (Cassar-PTT)
W88-02926

ASYMPTOTIC EIGENVALUE CURVES OF RANDOM COVARIANCE MATRICES,
Scripps Institution of Oceanography, La Jolla, CA.
R. W. Preisendorfer.
SIO Reference Series 81-3, April 1981. 40 p, 6 fig, 2 tab, 18 ref, 2 append.

Descriptors: *Data processing, *Meteorology, *Weather forecasting, Mathematical studies, Eigenvalues, Climatology, Statistical analysis, Monte Carlo method.

A simple analytical method estimates the set of average eigenvalues of certain random covariance matrices of large order. Such matrices are associated with the principal component decomposition of spatially-extensive, long-time oceanographic or meteorologic data sets. The method intended as a supplement to the Monte Carlo procedures used to obtain principal component eigenvalue statistics. Also, in certain simple instances, it is intended to facilitate the selection of statistically significant eigenvalues of given data sets. The method allows the analytical determination of average-eigenvalue distributions of certain very-large-order random covariance matrices which otherwise would be impossible or uneconomical to obtain by brute-force numerical methods. These results dispel some existing ideas about eigenvalue curves associated with empirical orthogonal functions of meteorologic fields. (Cassar-PTT)
W88-02946

WATER-QUALITY DATA FOR AQUIFERS IN EAST-CENTRAL NEW JERSEY, 1981-82,
Geological Survey, Trenton, NJ. Water Resources Div.
D. A. Harriman, and L. M. Voronin.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-821, 1984. 39 p, 2 fig, 1 plate, 6 tab, 30 ref.

Descriptors: *Water quality, *Aquifers, *Analytical techniques, *New Jersey, *Ocean County, Hydrological data, Water resources, Hydrology, Sampling methods, Groundwater, Organic compounds, Data collection, Salinity, Surface water, Monmouth County, New Jersey Coastal Plain.

Data are presented in tables for 238 wells representing nine aquifers underlying the New Jersey Coastal Plain. Approximately two-thirds of these wells are screened in the unconfined Kirkwood-Cohansey aquifer system, the principal source of groundwater in the study area. In addition, seven local streams were sampled in their headwaters under base flow conditions. Field measurements include water temperature, specific conductance, pH, and alkalinity; laboratory determinations include common inorganic ions, nutrients, trace metals, dissolved organic carbon, and volatile organic compounds. Other tables include lithology and hydrologic characteristics of geologic units, well-construction data, and median and extreme values of constituents in water of the Kirkwood-Cohansey aquifer system. A plate shows all sampling sites and presents three hydrogeologic sections delineating subsurface relationships. (USGS)
W88-02956

GEOHYDROLOGIC DATA FOR TEST WELL UE-25P 1, YUCCA MOUNTAIN AREA, NYE COUNTY, NEVADA,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-02957

ANNUAL GROUND-WATER USE IN THE TWIN CITIES METROPOLITAN AREA, MINNESOTA, 1970-79,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 6D.
W88-02958

MAP SHOWING OUTCROPS OF PRE-QUATERNARY ASH-FLOW TUFFS AND VOLCANICLASTIC ROCKS, BASIN AND RANGE PROVINCE, NORTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
J. E. Jenness, T. L. T. Grose, and D. A. Lopez.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4115-D, 1984. 9 p, 2 fig, 12 ref, 1 map.

Descriptors: *Ash-flow tuffs, *Volcaniclastic rocks, *Basin and range province, *California, Geology, Hydrogeology, Maps.

Outcrops of ash-flow tuffs and volcaniclastic rocks have been delineated in northern California as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The lithologic character, thickness, geologic age, distribution, and sources of data of the ash-flow tuffs and volcaniclastic rocks are described. (USGS)
W88-02971

MAPS SHOWING GROUND-WATER UNITS, WITHDRAWAL, AND LEVELS; SPRINGS; AND DEPTH TO GROUND WATER, BASIN AND RANGE PROVINCE, NORTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-02981

HYDROGEOLOGY OF THE SULPHUR SPRINGS AREA, TAMPA, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. W. Stewart, and L. R. Mills.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4085, 1984. 20 fig, 2 tab, 19 ref, 1 map.

Descriptors: *Sinks, *Groundwater movement, *Groundwater pollution, *Florida, *Sulfur Springs, Aquifer characteristics, Karst hydrology, Hillsborough County, Tampa.

The Sulfur Springs area includes about 56 square miles in west-central Hillsborough County, Florida. The north-central part of the city of Tampa is highly urbanized; the north-west part of the area is rural or undeveloped. The area has numerous sinkholes, two of which are used as retention basins for urban storm runoff. An intermittent stream discharges into a sinkhole that is hydraulically connected with the Floridian aquifer. A well-developed cavity system occurs in the upper part of the aquifer in the southwestern and southeastern parts of the area. Groundwater velocities of 4,200 to 9,200 feet per day were determined from dye tests conducted in a sinkhole area north of Sulfur Springs. Sulfur Springs provides the city of Tampa a supplemental water supply of 20 million gallons per day. Periodically, the spring pool is closed to swimming because of the high bacteria counts in the water. The source of bacteria appears to be an internally drained sinkhole area north of the spring. In 1980, groundwater use in the study area, excluding withdrawals from Sulphur Springs, was 7.2 million gallons per day, largely for public water supplies. The city of Tampa pumped an average of 48.5 million gallons per day from the Tampa Dam Reservoir on the Hillsborough River. (USGS)
W88-02999

HYDROLOGIC DATA FOR URBAN STUDIES IN THE HOUSTON, TEXAS, METROPOLITAN AREA, 1980,
Geological Survey, Austin, TX. Water Resources Div.
F. Liscum, J. S. Hutchinson, J. H. Bruchmiller, and L. S. Walther.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 82-264, 1983. 272 p, 20 fig, 18 tab, 6 ref.

Descriptors: *Houston, *Hydrologic data, *Data collections, Texas, Rainfall-runoff relationship, Storm runoff, Streamflow, Urban areas.

This report contains rainfall and runoff data collect during the 1980 water year for drainage basins in the Houston, Texas, metropolitan area. The information will be useful in determining the extent to which progressive urbanization will affect the yield and mode of occurrence of storm runoff. Rainfall-runoff computations are presented for 13 storm periods during the 1980 water year. (USGS)
W88-03001

A TWO-DIMENSIONAL GRAPHING PROGRAM FOR THE TEKTRONIX 4050-SERIES GRAPHICS COMPUTERS,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03002

PRELIMINARY ASSESSMENT OF THE GROUND-WATER RESOURCES OF THE ALLUVIAL AQUIFER, WHITE RIVER VALLEY, RIO BLANCO COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03012

PRECISION AND BIAS OF SELECTED ANALYTES REPORTED BY THE NATIONAL ATMOSPHERIC DEPOSITION PROGRAM AND NATIONAL TRENDS NETWORK--1983 AND JANUARY 1980 THROUGH SEPTEMBER 1984,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 5A.
W88-03023

GROUND-WATER LEVELS AND USE OF WATER FOR IRRIGATION IN THE SARATOGA VALLEY, SOUTH-CENTRAL WYOMING, 1980-81,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 6G.
W88-03025

ESTIMATED MONTHLY PERCENTILE DISCHARGES AT UNGAGED SITES IN THE

UPPER YELLOWSTONE RIVER BASIN IN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03037

WATER QUALITY OF STREAMS IN SANTA CLARA VALLEY, SANTA CLARA COUNTY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03038

ALTITUDE AND CONFIGURATION OF THE WATER TABLE IN THE HIGH PLAINS AQUIFER OF KANSAS, 1975,
Geological Survey, Garden City, KS. Water Resources Div.
L. E. Stullken, and M. E. Pabst.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 81-144, 1981. 1 sheet (map), 4 fig, 18 ref.

Descriptors: *Water table, *Potentiometric level, *Kansas, *High Plains, Aquifers, Great Plains, Groundwater, Subsurface waters, Unconfined aquifers, Underflow, Water-bearing formations, RASA studies.

The High Plains aquifer in Kansas is a part of a regional system that extends from South Dakota to Texas. The aquifer in Kansas underlies an area of 30,900 square miles in the western and south-central part. This aquifer is a hydraulically connected assemblage of unconsolidated water-bearing deposits of Tertiary and Quaternary age. Maps published at a scale of 1:500,000 show the altitude and configuration of the water table in Kansas during 1975. Groundwater moves from higher altitudes in the western part of the High Plains to lower altitudes in the eastern part; the slope of the water table averages 10 feet per mile. The upgradient flexure of water table contours along some of the valleys indicates that groundwater is discharged to the streams in those areas. (USGS)
W88-03045

POTENTIOMETRIC SURFACES OF THE COASTAL PLAIN AQUIFERS OF SOUTH CAROLINA, PRIOR TO DEVELOPMENT,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03047

PHYSICAL AND CHEMICAL DATA FOR NORTHERN SAN FRANCISCO BAY, CALIFORNIA, SEPTEMBER THROUGH NOVEMBER 1984,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2L.
W88-03066

GROUNDWATER LEVELS IN ALASKA, 1983,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03069

HYDROLOGIC AND MICROMETEOROLOGIC DATA FROM AN UNSATURATED ZONE STUDY AT A LOW-LEVEL RADIOACTIVE WASTE BURIAL SITE NEAR BARNWELL, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03071

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT AND VICINITY, FLORIDA, MAY 1986,
Geological Survey, Orlando, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03072

WATER RESOURCES ACTIVITIES IN NEW YORK 1985-86,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03073

PROGRESS REPORT ON BLACK MESA MONITORING PROGRAM--1985-86,
Geological Survey, Flagstaff, AZ. Water Resources Div.
For primary bibliographic entry see Field 4C.
W88-03074

GROUNDWATER-QUALITY DATA FOR PICATINNY ARSENAL, NEW JERSEY, 1958-85,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03075

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GW IN CHAMBERS, LIBERTY, AND MONTGOMERY COUNTIES, TEXAS, 1980-84,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03076

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUNDWATER IN BRAZORIA, FORT BEND, AND WALLER COUNTIES, TEXAS, 1980-84,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03077

PERMITTED WATER USE IN IOWA, 1985,
Geological Survey, Iowa City, IA. Water Resources Div.
For primary bibliographic entry see Field 6D.
W88-03078

USE AND AVAILABILITY OF CONTINUOUS STREAMFLOW RECORDS IN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
J. R. Schuetz.
Available from USGS, OFSS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-685, 1986. 33 p, 2 fig, 2 tab, 7 ref.

Descriptors: *Hydrologic data, *Regional analysis, *Wyoming, Regional planning.

This report documents a survey that identifies local, State, and Federal uses of data from 139 continuous-record, surface-water stations, presently (1984) operated by the Wyoming District of the U. S. Geological Survey; identifies sources of funding pertaining to collections of streamflow data; and presents frequency of data availability. Uses of data from the 139 stations are categorized into seven classes: Regional Hydrology, Hydrology Systems, Legal Obligations, Planning and Design, Project Operation, Hydrologic Forecasts, and Water Quality Monitoring. Sufficient use of surface water data collected from the stations justifies the continued operation of all stations. (USGS)
W88-03079

APPROXIMATE WATER-LEVEL CHANGES IN THE CHICOT AND EVANGELINE AQUIFERS, 1977-85 AND 1984-1985 AND MEASURED COMPACTION, 1973-85, IN HARRIS AND GALVESTON COUNTIES, TEXAS,
Geological Survey, Houston, TX. Water Resources Div.
J. F. Williams, and C. E. Ranzau.
Available from USGS, OFSS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-158, 1985. 6 sheets (maps), 6 fig.

Descriptors: *Texas, *Subsidence, *Withdrawal, Groundwater, Water levels, Water level fluctuations, Compaction, Land-surface subsidence, Compaction monitors.

This reports consists of: (1) Four maps that present data on water-level changes during 1977-85 and 1984-85 in the Chicot and Evangeline aquifers and (2) one set of graphs and one map that present data on the compaction of subsurface materials for 1973-85. (USGS)
W88-03080

WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN WYOMING, FISCAL YEAR 1985,
Geological Survey, Cheyenne, WY. Water Resources Div.
S. L. Green.
Available from USGS, OFSS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 85-562, 1985. 109 p, 5 fig, 4 tab.

Descriptors: *Hydrologic data, *Wyoming, Streamflow, Sediment load, Water quality, Groundwater, Water supply, Environmental effects, Oil shale, Water resources, Coal regions.

This report contains lists and location maps of streamflow and reservoir stations, water quality stations, sediment stations, and groundwater observation wells where data are currently being collected. Water resources appraisal projects in Wyoming are described, including many that are related to development of energy resources. The general locations of most projects are shown on maps. The U.S. Geological Survey is striving to coordinate its water resources activities with those of other agencies. This report is one phase of that coordination effort, and serves as an annual progress report to cooperators and the public. (USGS)
W88-03081

ANNUAL YIELD AND SELECTED HYDROLOGIC DATA FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS-OKLAHOMA, 1985 WATER YEAR,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03085

MAP OF CALIFORNIA SHOWING DISTRIBUTION OF SELENIUM CONCENTRATIONS IN WELLS SAMPLED BY THE U.S. GEOLOGICAL SURVEY, 1975-1985,
Geological Survey, Sacramento, CA. Water Resources Div.
K. D. Evenson, and J. M. Neil.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 86-72, 1986. 1 sheet (map), 1 fig, 3 tab, 3 ref.

Descriptors: *Selenium, *California, *Water pollution, Groundwater, Water quality, Areal distribution, Data summary.

Samples from 230 wells in California were analyzed for dissolved selenium during 1975-85. Most of the sample wells are concentrated in eight areas of the State. Selenium was detected in all eight areas; however, only 6 of the 230 wells had concentrations greater than 10 micrograms per liter. Selenium was detected most frequently in wells of the Davis-Woodland area of the Sacramento Valley and in wells in Santa Barbara County. (USGS)
W88-03088

GROUNDWATER DATA, GREEN RIVER BASIN, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
E. A. Zimmerman, and K. R. Collier.
Available from USGS, OFSS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 83-943, 1985. 511 p, 8 fig, 6 tab, 14 ref.

Descriptors: *Geohydrology, *Basic data collection, *Wyoming, *Hydrologic data, *Green River basin, *Wyoming, Water wells, Well data, Water quality, Specific conductance, Water temperature.

Hydrologic and geologic data collected by the U.S. Geological Survey as part of energy-related projects in the Green River basin of Wyoming are compiled from the files of the Geological Survey and the Wyoming State Engineer as of 1977. The data include well and spring location, well depth, casing diameter, type of lifts, type of power, use of water, rock type of producing zone, owner, and discharge for more than 1,600 sites. Analyses for common chemical constituents, trace elements, and radioactive chemicals are tabulated as well as water temperature and specific conductance measurement data. Lithologic logs of more than 300 wells, test holes, and measured sections constitute much of this report. County maps at a scale of 1:500,000 show the locations. (USGS)
W88-03089

WATER-LEVEL MEASUREMENTS FOR THE COASTAL PLAIN AQUIFERS OF SOUTH CAROLINA PRIOR TO DEVELOPMENT,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03090

REGRESSION MODELING OF GROUNDWATER FLOW,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03095

GROUNDWATER HYDROLOGY OF ELK RIVER BASIN, WEST VIRGINIA,
Geological Survey, Charleston, WV. Water Resources Div.
G. M. Ferrell.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. West Virginia Groundwater Atlas, 1985. 1 sheet (map), 9 fig, 6 tab, 23 ref.

Descriptors: *Groundwater, *Water quality, *West Virginia, Saline water, Geohydrologic units, Water yield, Maps, Appalachian Plateau, Elk River Basin.

This atlas report describes the groundwater resources of the Elk River basin of central West Virginia. The river basin is approximately 90 miles long and 20 miles wide and drains 1,532 square miles in central West Virginia. Precipitation is the major source of groundwater recharge. Groundwater supply at shallow depth is generally adequate for domestic use throughout the basin. The reported yields of wells range from less than 1 to 1,000 gallons per minute. Well yields vary with topographic setting, geologic structure, and well depths. Wells located in valleys and/or near the axis of highly fractured zones, such as faults and anticlinal folds, tend to yield more water than wells in other locations. The chemical quality of groundwater is highly variable but generally acceptable for most domestic uses, although iron concentrations exceeding 300 micrograms per liter occur in much of the basin. The groundwater found in the western half of the basin is commonly hard. Locally, areas of salty water exist and particularly along the axes of anticlines where oil and gas exploration has occurred. (USGS)
W88-03099

GROUNDWATER RESOURCES OF THE RAYVILLE-DELHI AREA, NORTHEASTERN LOUISIANA,
Geological Survey, Alexandria, LA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03100

COMPARISON OF TWO STREAM-DISCHARGE RECORD RECONSTRUCTION TECHNIQUES FOR EIGHT GAGING STATIONS IN MAINE,
Geological Survey, Augusta, ME. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03121

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER, WEST-CENTRAL FLORIDA, SEPTEMBER 1986,
Geological Survey, Tampa, FL. Water Resources Div.
B. R. Lewelling, and R. G. Belles.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-603, 1986. 1 sheet (map), 2 fig, 2 ref.

Descriptors: *Potentiometric levels, *Geohydrology, *Florida, *Maps, Groundwater movement, Hydrology.

A September 1986 potentiometric surface map of the Upper Floridan aquifer in west-central Florida depicts water levels for the annual high water level period. Water levels in most wells measured in September 1986 were higher than in May 1986. September levels averaged about 1 foot higher than May levels in latitudes north of the Hillsborough-Pasco County line and about 9 feet higher in southern areas. The average water-level change between September 1985 and September 1986 in individual wells was less than 1 foot. Average water levels in most wells measured in September 1986 were less than 1 foot lower than September 1985 levels in the north and less than 1 foot higher in the south. (USGS)
W88-03126

HYDROLOGIC DATA FROM NAVAL OIL SHALE RESERVES, PARACHUTE CREEK BASIN, NORTHWESTERN COLORADO, WATER YEARS 1982-83,
Geological Survey, Grand Junction, CO. Water Resources Div.
K. C. Galyean, R. A. Jenkins, and D. L Collins.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-647, 1985. 91 p, 4 fig, 56 tab, 4 ref.

Descriptors: *Hydrology, *Streamflow, *Water quality, *Climatic data, Precipitation, Conductivity, Temperature, Snow courses, Colorado, Naval Oil Shale Reserves, Parachute Creek basin, Piceance Creek structural basin, Rio Blanco County.

Data for water years 1982 and 1983, collected by the U.S. Department of Energy, Naval Petroleum and Oil Shale Reserves in the Parachute Creek drainage basin of western Colorado are summarized. These data are supplemental to data reported by Patt and others (1982) and Galyean and others (1983). Data from five streamflow-gaging stations, automatic sediment samplers, and two water quality monitors are presented. The sediment samplers and monitors are located at two of the streamflow-gaging stations. Climate data including mean, maximum, and minimum air temperature and relative humidity, daily solar radiation, mean wind velocity, and mean wind direction are reported for one site. Daily precipitation data are reported for three sites and snow-source data are reported for one site. (USGS)
W88-03131

STAGE-DISCHARGE RELATIONS FOR TOMBIGBEE RIVER AT ALICEVILLE LOCK AND DAM, NEAR PICKENSVILLE, ALABAMA--UPDATED 1985,
Geological Survey, Montgomery, AL. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03136

CLIMATIC DATA FOR THE COTTONWOOD LAKE AREA, STUTSMAN COUNTY, NORTH DAKOTA, 1982,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2H.
W88-03137

WATER-RESOURCES DATA FOR THE MOUNT SHASTA AREA, NORTHERN CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03138

AVAILABILITY OF SELECTED METEROLOGICAL DATA IN COMPUTER-BASED FILES OF THE U.S. GEOLOGICAL SURVEY, MONTANA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2B.
W88-03139

APPLICATION OF THE PRINCIPLE OF MAXIMUM ENTROPY (POME) TO HYDROLOGIC FREQUENCY ANALYSIS,
Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W88-03181

THEORETICAL ASSESSMENT OF CASING STORAGE EFFECTS WHEN PUMP SAMPLING A PARTIALLY PENETRATING BOREHOLE,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Groundwater Research.
For primary bibliographic entry see Field 8B.
W88-03273

ADVANTAGES OF NONPARAMETRIC PROCEDURES FOR ANALYSIS OF WATER QUALITY DATA,
Geological Survey, Reston, VA. Water Resources Div.
D. R. Helsel.
Hydrological Sciences Journal HSJODN, Vol. 32, No. 2, p 179-190, June 1987. 2 fig, 6 tab, 14 ref.

Descriptors: *Data interpretation, *Nonparametric data analysis, *Statistics, *Nonparametric methods, *Water quality, Statistical analysis, Statistical methods, Mathematical studies, Case studies, Analysis of variance, Discriminant analysis, Detection limits.

Water quality data are usually analyzed with parametric statistical procedures requiring the normality assumption for accuracy of their attained significance levels. However, these data are typically non-normally distributed. When applied to non-normal data, the power of parametric procedures is low, and their results may be in error. Three typical case studies are discussed: differentiation of water quality in streams using analysis of variance; discernment of water quality types using discriminant analysis; and t-tests on differences between two groups which include data below the detection limit. Five important advantages of nonparametric methods over commonly used parametric procedures are detailed. They include: (1) no need for prior transformations even when approximate normality could be achieved; (2) successful analysis of cases in which normality for all groups to be compared is not achievable; (3) greater power achievement for the skewed distributions common to water quality data; (4) use of central values such as the median for comparisons rather than the mean; and (5) possible incorporation of data below the detection limit without fabrication of values or bias. (Wood-PTT)
W88-03276

RESOLUTION ENHANCEMENT OF MULTICHANNEL MICROWAVE IMAGERY FROM THE NIMBUS-7 SMMR FOR MARITIME RAINFALL ANALYSIS,
Wisconsin Univ., Madison. Dept. of Meteorology.
W. S. Olson, C.-L. Yeh, J. A. Weinman, and R. T. Chin.
Journal of Atmospheric and Oceanic Technology, Vol. 3, No. 3, p 422-432, September 1986. 5 fig, 1 tab, 12 ref. NASA Grant NAGW-380 and NSF Grant ATM-8212424.

Descriptors: *Data interpretation, *Microwaves, *Microwave imagery, *Remote sensing, *Satellite technology, *Rainfall, Deconvolution method, Maritime rainfall, Rainfall analysis, Satellite technology, Nonlinear programming, Mathematical equations, Mathematical studies, Precipitation, Rainfall distribution.

A restoration of the 37, 21, 18, 10.7 and 6.6 GHz satellite imagery from the Scanning Multichannel Microwave Radiometer (SMMR) aboard the Nimbus-7 to 22.2 km resolution is attempted using a deconvolution method based upon nonlinear programming. The images are deconvolved with and without the aid of prescribed constraints, which force the processed image to abide by partial a priori knowledge of the high-resolution result. The restored microwave imagery may be used to examine the distribution of precipitating liquid water in maritime rain systems. The restoration method presented here may also be applied to other types of meteorological satellite imagery. Prerequisites for application are (i) the data must be interpolated to a regular grid, and (ii) an estimate of the antenna blurring function must be made in that particular grid coordinate system. (Author's abstract)
W88-03284

DYNAMIC RESPONSE OF THE FINE WIRE PSYCHROMETER FOR DIRECT MEASUREMENT OF WATER VAPOR FLUX,
Okayama Univ. (Japan).
O. Tsukamoto.
Journal of Atmospheric and Oceanic Technology, Vol. 3, No. 3, p 453-461, September 1986. 15 fig, 14 ref.

Descriptors: *Data interpretation, *Psychrometers, *Humidity, *Water vapor, *Water vapor flux, Water vapor fluctuations, Mathematical equations, Wind velocity, Measuring instruments.

For the measurement of humidity fluctuation in the atmospheric boundary layer, a wet- and dry-bulb thermocouple psychrometer has traditionally been used. However, in the direct measurement of water vapor flux with the eddy correlation method, errors are caused by its slow response to humidity fluctuations. The error in the water vapor flux measurement with psychrometers was studied based on the dynamic response equation of wet and dry bulb thermometers. A new method of correction is presented for the slow response of a fine wire psychrometer with variable time constants and with fluctuating wind speed which is appropriate for use for real time correction when wind speed fluctuation is measured. It was applied to a water vapor flux estimation experiment in 1981 and the results are compared with the water vapor flux with fast response hygrometer. Satisfactory improvement in the psychrometric data was observed. (Wood-PTT)
W88-03285

NUMERICAL SIMULATION OF STORM SURGES IN BANGLADESH USING A BAY-RIVER COUPLED MODEL,
Indian Inst. of Tech., New Delhi. Centre for Atmospheric and Fluids Sciences.
S. K. Dube, P. C. Sinha, and G. D. Roy.
Coastal Engineering COENDE, Vol. 10, No. 1, p 85-101, May 1986. 6 fig, 33 ref.

Descriptors: *Model studies, *Storm surges, *Storms, *Hydrodynamic models, *Rivers, *Numerical analysis, River mouth, Surges, Cyclones, Bangladesh, Hydrodynamics, Simulation, Simulation analysis, Meghna River, Wind, Prediction, Mathematical studies, Mathematical equations, Comparison studies.

A numerical hydrodynamic model is described for the simulation of storm surges in Bangladesh. The model applies to a region including the river Meghna and allows the freshwater discharge through the river to be taken into account. By using forcing wind stress distribution representative of the 1970 Chittagong cyclone, a comparison is made between model simulations both with and without inclusion of the river along the Bangladesh coast. It was concluded that the introduction of the effect of a river in storm surge models may lead to an important change in detailed prediction; surge response inside the river depends significantly upon the freshwater discharge. (Author's abstract)
W88-03296

GROUNDWATER DATA FROM THE SAN MIGUEL RIVER BASIN, SOUTHWESTERN COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03300

STREAMFLOW STATISTICS AND DRAINAGE BASIN CHARACTERISTICS FOR THE SOUTHWESTERN AND EASTERN REGIONS, WASHINGTON, VOLUME I. SOUTHWESTERN WASHINGTON; VOLUME II. EASTERN WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03301

FLOOD OF NOVEMBER 1985 IN WEST VIRGINIA, PENNSYLVANIA, MARYLAND, AND VIRGINIA,
Geological Survey, Pittsburgh, PA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03305

HYDROGEOLOGIC DATA FOR THE DAKOTA AQUIFER SYSTEM IN NEBRASKA,
Geological Survey, Lincoln, NE. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03306

WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN NEW-MEXICO--FISCAL YEAR 1986,
Geological Survey, Albuquerque, NM. Water Resources Div.
R. L. Knutilla.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-141, 1986. 83 p, 8 fig, 2 tab.

Descriptors: *Hydrologic data collections, *New Mexico, Stream gages, Observation wells, On-site investigations.

All U.S. Geological Survey hydrologic investigations in the New Mexico District in progress during fiscal year 1986 are summarized. The summaries include sections on the problem addressed, the objective and approach of the investigation, progress of the investigation and plans for 1986 fiscal year, and reports published as a result of the investigation. Water conditions in New Mexico during the 1985 water year are briefly described. Reports released during 1985 are listed. The New Mexico District office organization, cooperating agencies, and types of funding for the District operation are also summarized. (USGS)
W88-03309

CLIMATIC DATA FOR MIRROR LAKE, WEST THORNTON, NEW HAMPSHIRE, 1984,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2H.
W88-03310

WATER RESOURCES ACTIVITIES IN ILLINOIS, 1985,
Geological Survey, Urbana, IL. Water Resources Div.
M. L. Garrelts.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-130, 1986. 99 p, 11 fig, 3 tab, 4 ref.

Descriptors: *Hydrologic data, *Water data collection, *Illinois, Groundwater data, Surface water.

Water resources investigations of the U.S. Geological Survey in Illinois consist of collecting hydrologic data and making interpretative investigations. The data and the results of the investigations are published or released by either the U.S. Geological Survey or by cooperating agencies. This report describes the data collection activities and investigations in Illinois during the 1985 fiscal year and provides an extensive list of publications pertaining to the water resources of Illinois. (USGS)
W88-03311

WATER RESOURCES OF YANKTON COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03322

HYDROLOGIC MAPS OF THE PRICE 30 X 60 MINUTE QUADRANGLE, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
H. F. McCormack, K. L. Lindskov, and B. Stolp.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4227, 1984. 4 sheets (map), 2 fig, 4 tab, 15 ref.

Descriptors: *Sediment yield, *Dissolved solids, *Maps, *Hydrologic maps, Hydrology, Precipitation, Runoff, Price, Utah.

Four hydrologic maps of the Price 30 x 60-minute quadrangle, Utah show that the hydrology of the area is extremely variable. Normal annual precipitation ranges from less than 8 to more than 25 inches. Corresponding ranges are less than 0.1 to more than 5 inches for average annual runoff, 0.1 to 3.0 acre-ft/sq mi/yr for sediment yield, less than 200 to more than 6,000 milligrams/L for concentrations of dissolved solids in streamflow, and less than 500 to more than 2,000 milligrams/L for concentrations of dissolved solids in shallow groundwater. Variations in the hydrologic characteristics result from differences in geology, precipitation, soils, vegetative cover, and land use. (USGS)
W88-03328

WATER RESOURCES OF CLALLAM COUNTY, WASHINGTON: PHASE I REPORT,
Geological Survey, Tacoma, WA. Water Resources Div.
B. W. Drost.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 83-4227, 1986. 263 p, 1 fig, 15 tab, 5 plates, 30 ref.

Descriptors: *Surface waters, *Groundwater, *Water quality, *Washington, Hydrologic budget, Groundwater recharge, Aquifer characteristics, Saline water encroachment, Low flow, Water use, Clallam County.

An inventory of the water resources of Clallam County, Washington, showed that sufficient water is available to supply all present demands. Domestic water supplies can be obtained from wells drilled 100 ft or less into glacial and alluvial deposits; in areas underlain by bedrock, wells more than 100 ft deep can generally supply one home per well. Surface water is abundant, and is the source for most public water systems. Extreme low flows were observed only in small drainage basins in

bedrock in the mountainous interior and along parts of the coastline in the Strait of Juan de Fuca. The quality of ground and surface waters is generally excellent. In coastal areas, some wells may yield water with large concentrations of chloride and dissolved solids. A quarter of the wells tested had excessive concentrations of iron and (or) manganese. High values of turbidity, color, and coliform bacteria are widespread surface water problems, but standard filtering and chlorination treatment make the water suitable for public supplies. High concentrations of coliform bacteria apparently originate naturally in soils. High ammonia concentration observed at one site is probably caused by sewage disposal practices. (USGS)
W88-03331

STREAMFLOW SIMULATION FOR THE KENTUCKY RIVER NEAR LEXINGTON AND FRANKFORT, KENTUCKY,
Geological Survey, Louisville, KY. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03334

PRELIMINARY APPRAISAL OF GROUND WATER IN AND NEAR THE ANCESTRAL MISSOURI RIVER VALLEY, NORTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03340

MAPS OF THE BONSALL AREA OF THE SAN LUIS REY RIVER VALLEY, SAN DIEGO, CALIFORNIA; SHOWING GEOLOGY, HYDROLOGY, AND GROUND-WATER QUALITY,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
J. A. Izbicki.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4112, 1985. 5 sheets (maps), 5 fig, 3 ref.

Descriptors: *Water quality, *Groundwater, *Geohydrology, *Groundwater quality, *California, *Maps, San Diego County, San Luis Rey River, Geology, Bonsall.

In November 1984, 84 wells and 1 spring in the Bonsall area of the San Luis Rey River valley were inventoried by U.S. Geological Survey personnel. Depth to water in 38 wells ranged from 1.3 to 38 ft and 23 wells had depths to water less than 10 feet. Dissolved solids concentration of water from 29 wells and 1 spring sampled in autumn 1983 and spring 1984 ranged from 574 to 2,370 mgs/L. Groundwater with a dissolved solids concentration less than 1,000 mgs/L was generally restricted to the eastern part of the aquifer. The total volume of alluvial fill in the Bonsall area is 113,000 acre-feet; the amount of groundwater storage available in the alluvial aquifer is 18,000 acre-feet. The alluvial aquifer is, in part, surrounded and underlain by colluvium and weathered crystalline rock that add some additional groundwater storage capacity to the system. Data in this report are presented on five maps showing well locations, thickness of alluvial fill, water level contours in November 1983 and hydrographs of selected wells, groundwater quality in spring 1960 and graphs showing changes in dissolved solids concentrations of water from selected wells with time, and groundwater quality in spring 1984. This report is part of a larger cooperative project between the Rainbow Municipal Irrigation District and the U.S. Geological Survey. The purpose of the larger project is to develop an appropriate groundwater management plan for the Bonsall area of the San Luis Rey River valley. (USGS)
W88-03349

OCCURRENCE OF GROUND-WATER AND POTENTIAL FOR SEAWATER INTRUSION, ISLAND COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
M. A. Jones.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 85-4046, 1985. 6 sheets (maps), 8 fig, 2 tab, 5 ref.

Descriptors: *Groundwater discharge, *Maps, *Washington, Groundwater recharge, Aquifers, Freshwater-saline water interfaces, Saline water intrusion, Groundwater pollution, Island County, Camano Island, Whidbey Island.

The data from a study of groundwater availability and quality in Island County, Washington, are presented. Increased groundwater withdrawals associated with the population increase in Island County have caused concern about groundwater availability and potential seawater intrusion. The most widely used aquifer lies near sea level. Locally, available data indicate that one or more water-bearing zones lie above the sea-level aquifer. Pumpage in 1979 was about 1.67 billion gallons, about 90% of which was pumped from the sea-level aquifer. Most large producing wells in the county have pumping water levels near or below sea level, so that if pumping continues for a long enough time, seawater intrusion would result. Chloride concentrations in water samples taken in July 1978, April 1980 and August 1980 indicate that seawater intrusion is occurring in northeastern and southern Camano Island and in central Whidbey island. (USGS)
W88-03350

HYDROLOGIC EFFECTS OF WITHDRAWAL OF GROUND-WATER ON THE WEST FARGO AQUIFER SYSTEM, CASS COUNTY, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03351

SURFICIAL GEOLOGY, STRUCTURE AND THICKNESS OF SELECTED GEOHYDROLOGIC UNITS IN THE COLUMBIA PLATEAU, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03360

ALTITUDE OF THE TOP OF SALINE GROUND WATER IN THE SOUTHEASTERN COASTAL PLAIN,
Geological Survey, Atlanta, GA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W88-03361

HYDROLOGY OF ISLAND FORD LAKE, HILLSBOROUGH COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 2H.
W88-03364

PRELIMINARY MAP SHOWING THE DIFFERENCE BETWEEN THE POTENTIOMETRIC SURFACES OF THE AQUIA AQUIFER OF APRIL 1979 AND SEPTEMBER 1982 IN SOUTHERN MARYLAND,
Geological Survey, Annapolis, MD. Water Resources Div.
F. K. Mack, J. C. Wheeler, and S. E. Curtin.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 83-930, 1983. 1 p, 1 fig.

Descriptors: *Maps, *Potentiometric levels, *Artesian aquifers, *Coastal Plain, *Maryland, Wells, Coastal plain, Anne Arundel County, Prince Georges County, Calvert County, Charles County, Cone of depression, Aquia aquifer, Groundwater levels, St. Marys County.

A map was prepared that shows the net change in the potentiometric surface of the Aquia aquifer in southern Maryland between April 1979 and September 1983. During this period, the potentiometric surface declined (1) at least a few feet throughout the entire southern Maryland area, and (2) more than 10 feet in the eastern Charles County area and in a few scattered localized areas. The network of observation wells was part of the cooperative program between the U.S. Geological Survey, the Maryland Geological Survey, and the Maryland Energy Administration. (USGS)
W88-03366

MAP SHOWING THE DIFFERENCE BETWEEN THE POTENTIOMETRIC SURFACES OF THE MAGOTHY AQUIFER OF SEPTEMBER 1975 AND SEPTEMBER 1982 IN SOUTHERN MARYLAND,
Geological Survey, Annapolis, MD. Water Resources Div.
F. K. Mack, J. C. Wheeler, and S. E. Curtin.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 83-4283, 1983. 1 p, 1 fig.

Descriptors: *Maps, *Potentiometric level, *Artesian aquifer, *Coastal Plain, *Maryland, Wells, Coastal Plain, Anne Arundel County, Prince Georges County, Calvert County, Charles County, Cone of depression, Magothy aquifer, Groundwater levels.

A map was prepared that shows the net change in the potentiometric surface of the Magothy aquifer in southern Maryland from September 1975 to September 1982. The map is based on measurements from a network of 55 observation wells. During the 8-year period, the potentiometric surface was (1) lowered by at least a few feet throughout the entire southern Maryland area, (2) lowered by at least 10 feet in the southern half of the area, and (3) lowered by 30 to 40 feet in most of northern Charles County. The network of observation wells was developed as part of the cooperative program between the U.S. Geological Survey, the Maryland Geological Survey, and the Maryland Energy Administration. (USGS)
W88-03367

MAP SHOWING THE POTENTIOMETRIC SURFACE OF THE MAGOTHY AQUIFER IN SOUTHERN MARYLAND, SEPTEMBER 1982,
Geological Survey, Annapolis, MD. Water Resources Div.
F. K. Mack, J. C. Wheeler, and S. E. Curtin.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 83-4282, 1983. 1 p, 1 fig.

Descriptors: *Maps, *Potentiometric levels, *Artesian aquifer, *Coastal plain, *Maryland, Wells, Coastal plain, Anne Arundel County, Prince Georges County, Calvert County, Charles County, Cone of depression, Magothy aquifer, Groundwater levels.

A map was prepared that shows the potentiometric surface of the Magothy aquifer in southern Maryland in September 1982. The map is based on measurements from a network of 83 observation wells. The highest levels of the potentiometric surface, 57 and 58 feet above sea level, were measured near the outcrop-subcrop of the aquifer in topographically high areas of Anne Arundel and Prince Georges Counties. The potentiometric surface slopes to the southeast to about sea level along much of the western shore of the Chesapeake Bay. Three distinct and extensive cones of depression have developed in the potentiometric surface around the well fields of the Annapolis area, Waldorf area, and Chalk Point. Several square miles of each cone are below sea level, and in some areas at Chalk Point and Waldorf, the cone is more than 50 feet below sea level. The network of wells was developed as part of the cooperative program between the U.S. Geological Survey, the Maryland Geological Survey, and the Maryland Energy Administration. (USGS)
W88-03368

CURRENT WATER RESOURCES ACTIVITIES IN ARKANSAS, 1984-85,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03371

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, SEPTEMBER 1984,
Geological Survey, Tampa, FL. Water Resources Div.
G. L. Barr.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 84-812, 1984. 1 sheet (map), 2 fig, 2 ref.

Descriptors: *Maps, *Potentiometric levels, *Florida, Potentiometric flow, Hydrology, Heohydrology. Southwest Florida Water Management District.

A September 1984 potentiometric surface map of the Southwest Florida Water Management District depicts the annual high water level period. Water levels in most wells measured in September 1984 were higher than in May 1984. September levels averaged less than 1 foot higher than May levels in areas north of latitude 28 degrees 7 feet and about 6 feet higher in southern areas. Generally, water levels in September 1984 were lower when compared to September 1983. Water levels in most wells measured in September 1984 averaged less than 1 foot lower than September 1983 levels in the north and about 2.6 feet lower in the south. (USGS)
W88-03372

WATER-RESOURCES ACTIVITIES IN UTAH BY THE U.S. GEOLOGICAL SURVEY, JULY 1, 1984 TO JUNE 30, 1985,
Geological Survey, Salt Lake City, UT. Water Resources Div.
S. L. Drago.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-493, 1985. 52 p, 4 fig.

Descriptors: *Projects, *Project planning, *Utah, Water resources studies, Hydrologic data, Groundwater, Surface water.

Twenty-three studies of water resources in Utah were conducted by the U.S. Geological Survey during July 1, 1984, through June 30, 1985. Seven of these studies were completed on or before June 30, 1985 or will be completed on September 30, 1985 and one study was discontinued during the year. Eighteen of these studies were in cooperation with Federal, State, county, or local agencies. Three additional studies are proposed to begin on July 1 or October 1, 1985. The 26 current and proposed projects include 5 involved mainly with collection of data, 4 concerned with the hydrology of Utah's energy resource areas, 2 focused on floods, 3 on surface water quality, 5 on groundwater in unconsolidated sediments in the basins of western Utah, 3 concerned with groundwater in consolidated rock, mostly in southeastern Utah, and 4 focused on groundwater quality. (USGS)
W88-03375

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO, 1984,
Geological Survey, Albuquerque, NM. Water Resources Div.
R. R. Cruz.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-645, 1985. 25 p, 13 fig, 7 tab, 4 ref.

Descriptors: *Hydrologic data, *Water resources data, *White Sands Missile Range, *New Mexico, Groundwater, Potentiometric level, Water quality, Slope-area measurement, Peak flow.

Hydrologic data were collected at White Sands Missile Range in 1984. The total groundwater withdrawal in 1984 was 685,275,000 gallons. The Post Headquarters well field produced 650,821,000 gallons in 1984. Six new wells were drilled at White Sands Missile Range in 1984. Nineteen water samples were collected for major chemical-constituent, trace-element, or radiochemical analysis in 1984. Depth-to-water measurements in the Post Headquarters supply wells showed seasonal fluctuations as well as continued long-term declines. (USGS)
W88-03376

USE AND AVAILABILITY OF CONTINUOUS STREAMFLOW RECORDS IN NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7A.
W88-03377

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN ARKANSAS--FISCAL YEARS 1982 AND 1983,
Geological Survey, Little Rock, AR. Water Resources Div.
B. L. Louthian.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 84-232, 1984. 49 p, 22 fig.

Descriptors: *Hydrologic data, *Hydrology, *Arkansas, Groundwater, Surface water, Water quality, Hydrologic investigations.

During fiscal years 1982 and 1983 there were 22 water resources investigations in progress by the Arkansas District of the U.S. Geological Survey's Water Resources Division. Investigations that mainly involved data collection included surface water gaging, water level measuring, water quality sampling, sediment sampling and water use inventorying. Interpretive studies included two that were principally of groundwater resources, five that were of surface water flow characteristics, one that was of surface water quality characteristics and six that were interdisciplinary. (USGS)
W88-03378

GROUND-WATER DATA FOR THE ALLUVIAL, BURIED CHANNEL, BASAL PLEISTOCENE AND DAKOTA AQUIFER IN WEST-CENTRAL IOWA,
Geological Survey, Iowa City, IA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03379

JANUARY 1985 WATER LEVELS, AND DATA RELATED TO WATER-LEVEL CHANGES, WESTERN AND SOUTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03387

BASE FLOW MEASUREMENTS AT PARTIAL-RECORD SITES ON SMALL STREAMS IN SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03389

FLOODS IN THE FLOYD RIVER BASIN, IOWA,
Geological Survey, Iowa City, IA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W88-03391

INDEX OF HYDROLOGIC DATA FOR SELECTED SITES IN PALM BEACH COUNTY, FLORIDA, 1928-80,
Geological Survey, Miami, FL. Water Resources Div.
R. S. Sonenshein, C. R. Causaras, and J. E. Fish.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-54, 1986. 3 p (maps), 14 fig, 5 tab, 16 ref.

Descriptors: *Maps, *Water quality, *Geohydrology, *Groundwater quality, *Florida, *Biscayne aquifer, Hydrology, Geology, Palm Beach County, Surficial aquifers.

A regional assessment of the surficial aquifers in Dade, Broward, and Palm Beach Counties, Florida, including the Biscayne aquifer, was begun in 1979 by the U.S. Geological Survey, in cooperation with the South Florida Water Management District. The purpose of the first phase of the project was to determine the geologic, hydrologic, and water quality data available in the files of the U.S. Geological Survey and other public agencies. This report summarizes, through tables and maps, the types of data available for Palm Beach County. (USGS)
W88-03396

OBSERVATION-WELL NETWORK IN ILLINOIS, 1984,
Geological Survey, Urbana, IL. Water Resources Div.
D. C. Voelker.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-416, 1986. 108 p, 2 fig, 6 tab, 5 ref.

Descriptors: *Groundwater, *Water quality, *Observation wells, *Groundwater quality, *Illinois, Data collections.

Water quality and geohydrologic information are presented for 106 public water supply wells in Illinois. These wells were sampled during April-December 1984, as part of a pilot program to develop an observation well network in the State. The pilot program was designed to sample single-aquifer wells from three major aquifer systems--(1) sand and gravel, both confined and unconfined, (2) Silurian dolomite, and (3) the Ironton-Galesville deep sandstone. Data are tabulated for water temperature, pH, specific conductance, oxidation-reduction potential, ammonia nitrogen, nitrate + nitrite nitrogen, phosphorus, silica, arsenic, lead, mercury, fluoride, chloride, sulfate, cyanide, phenols, selenium, residue on evaporation at 180 C, alkalinity, calcium, magnesium, sodium, potassium, barium, boron, beryllium, cadmium, chromium, copper, cobalt, iron, aluminum, manganese, nickel, silver, strontium, vanadium, zinc, and selected geohydrologic information. (USGS)
W88-03397

HYDROLOGIC DATA FOR THE WELDON SPRING RADIOACTIVE WASTE-DISPOSAL SITES, ST. CHARLES COUNTY, MISSOURI--1984-1986,
Geological Survey, Rolla, MO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W88-03398

APPROXIMATE ALTITUDE OF WATER LEVELS IN WELLS IN THE CHICOT AND EVANGELINE AQUIFERS IN THE HOUSTON AREA, TEXAS,
Geological Survey, Houston, TX. Water Resources Div.
J. F. Williams, C. E. Ranzau, and L. S. Coplin.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-306, 1986. 2 p (maps), 2 fig, 1 ref.

Descriptors: *Maps, *Groundwater, *Water levels, *Water level fluctuations, *Texas, Houston.

These two maps show water levels in wells in the Houston, Texas, area in (1) the Chicot aquifer, spring 1986, and (2) the Evangeline aquifer, spring 1986. Both the Chicot and Evangeline aquifers are composed of several sand layers with different potentiometric surfaces. These maps, however, show approximations of single potentiometric surfaces that represent composite hydraulic heads. (USGS)

W88-03402

GROUND-WATER DATA FOR MICHIGAN--1985,
Geological Survey, Lansing, MI. Water Resources Div.
G. C. Huffman.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-417, 1986. 50 p, 5 fig, 3 tab, 112 ref.

Descriptors: *Groundwater data, *Groundwater hydrographs, *Michigan, Water resources, Water levels, Water use, Water quality.

Water levels, location, depths, and aquifers tapped are given for 113 observation wells in Michigan. Tabulated data include extremes of water levels for 1985 and for the period of record, pumpage of most major groundwater users in the state, and water quality data from selected wells. (USGS)
W88-03403

APPROXIMATE WATER-LEVEL CHANGES IN THE CHICOT AND EVANGELINE AQUIFERS, 1977-86, AND 1985-86 AND MEASURED COMPACTION, 1973-86, IN HARRIS AND GALVESTON COUNTIES, TEXAS,
Geological Survey, Houston, TX. Water Resources Div.
J. F. Williams, and C. E. Ranzau.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-135, 1986. 7 sheets, 5 maps, 6 fig.

Descriptors: *Groundwater, *Subsidence, *Houston, *Texas, *Maps, Water levels, Water level fluctuations, Compaction, Land-surface subsidence, Compaction monitors.

This report consists of: (1) Four maps that present data on water level changes during 1977-86 and 1985-86 in the Chicot and Evangeline aquifers, Houston, Texas, and (2) one set of graphs and one map that present data on land subsidence and compaction of subsurface materials for 1973-86. (USGS)
W88-03404

GROUND-WATER DATA FOR GEORGIA, 1985,
Geological Survey, Doraville, GA. Water Resources Div.
J. S. Clarke, C. N. Joiner, S. A. Longsworth, K. W. McFadden, and M. F. Peck.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-304, 1986. 159 p, 75 fig, 51 tab, 46 ref.

Descriptors: *Groundwater, *Water levels, *Water quality, *Aquifers, *Georgia, *Groundwater levels, *Groundwater quality, Hydrologic data.

Continuous water level records from 146 wells and water level measurements from an additional 1,100 wells in Georgia during 1985 provide the basic data for this report. Hydrographs for selected wells illustrate the effects that changes in recharge and discharge have had on the groundwater reservoirs in the State. Daily mean water levels are shown in hydrographs for 1985. Monthly mean water levels are shown for the 10-year period 1976-86. During 1985, annual mean water levels were generally lower than in 1984, and ranged from 11.4 feet lower to 0.6 feet higher. Much of the decline can be attributed to below-normal precipitation from mid-1984 to mid-1985. Water quality samples also are collected periodically throughout Georgia and analyzed as part of areal and regional groundwater studies. Along the coast, the chloride concentration in the Floridan aquifer system generally remained stable in the Savannah and Brunswick areas. (USGS)
W88-03405

HYDROGEOLOGIC DATA FROM A TEST WELL NEAR PONTE VEDRA, NORTHEAST ST. JOHNS COUNTY, FLORIDA,
Geological Survey, Jacksonville, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03406

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN CENTRAL SUMTER COUNTY, FLORIDA, SEPTEMBER 1986,
Geological Survey, Orlando, FL. Water Resources Div.
L. A. Bradner.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 87-34, 1987. 1 sheet (map).

Descriptors: *Geohydrology, *Maps, *Potentiometric levels, *Aquifers, *Florida, Groundwater levels, Hydrologic aspects, Sumter county.

This map shows the potentiometric surface of the Upper Floridan aquifer in central Sumter County, Florida, for September 1986. The Upper Floridan aquifer is the principal source of potable water in the area. The focus of the map is in the Jumper Creek Canal area where mine pumpage affects water levels. Water levels rose approximately 2 to 3 feet in the southern part of the study area between May and September but remained stable in the northern part. The potentiometric surface ranged in altitude from more than 90 ft in the southeastern part of the county to less than 40 feet northwest of Lake Panasoffkee in the west-central area. (USGS)
W88-03408

GROUND-WATER LEVELS IN WATER YEARS 1984-86 AND ESTIMATED GROUNDWATER PUMPAGE IN WATER YEARS 1984-85, CARSON VALLEY, DOUGLAS COUNTY, NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03409

RECORDS OF WELLS AND WATER-LEVEL FLUCTUATIONS FROM THE STATEWIDE OBSERVATION-WELL NETWORK IN MONTANA THROUGH 1985,
Geological Survey, Helena, MT. Water Resources Div.
M. F. Johnston, and K. A. Dodge.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-528, 1986. 221 p, 3 fig, 3 tab, 13 ref.

Descriptors: *Observation wells, *Hydrologic data, *Water levels, *Montana, *Water level fluctuations, Groundwater hydrology, Geology.

The statewide observation-well network of the U.S. Geological Survey was developed in Montana in 1947 to record long-term fluctuations of water levels in selected wells. This report was prepared to summarize well records and water levels for the network and to show the location and density of the wells. Data for 299 wells are tabulated in this report, generally within the interval 1947-85. The well records include altitude of land surface, date drilled, well depth, use of site, use of water, casing type, casing size, casing depth, top and bottom of perforations, principal aquifer, year water-level measurements began and measurement frequency, year chemical analysis began, type of analysis, analyzing agency, and type of logs available. The water-level data include date of measurement and depth to water below land surface. Well location and density are shown on a map at a scale of 1:1,000,000. (USGS)
W88-03411

POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN CENTRAL SUMTER COUNTY, FLORIDA, MAY 1984,
Geological Survey, Orlando, FL. Water Resources Div.
L. A. Bradner.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 84-814, 1984. 1 sheet (map), 1 fig.

Descriptors: *Potentiometric levels, *Groundwater, *Geohydrology, *Maps, *Florida, Hydrologic aspects, Aquifers, Sumter County.

This map presents the potentiometric surface of the upper Floridan aquifer in central Sumter County, Florida, for May 1984. The Floridan aquifer system is the principal source of potable water in the area. The focus of the map is the potentiometric surface in the Jumper Creek Canal area. Water level measurements were made on approximately 60 wells. The potentiometric surface ranged in altitude from more than 90 feet in the southeastern part of the county to less than 40 feet northwest of lake Panasoffkee in the west-central area. (USGS)
W88-03415

DATA USES AND FUNDING OF THE STREAMFLOW-GAGING PROGRAM IN NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03416

LINEAR FEATURES DETERMINED FROM LANDSAT IMAGERY IN THE TEXAS AND OKLAHOMA PANHANDLES,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. E. Cooley.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 84-589, 1984. 1 sheet (map), 1 fig, 2 ref.

Descriptors: *Remote sensing, *Linear trends, *High Plains, *Ogallala aquifer, *Landsat imagery, *Texas, *Oklahoma, *Maps, Satellite technology, Geologic faults, Geologic joints, Lineaments, Regional Aquifer System Analysis.

A map (scale 1:500,000) shows the linear features determined from Landsat imagery in the Texas and Oklahoma panhandles. The linear features, sometimes called linear trends or lineaments, are not identified as to type or origin. Most probably represent fractures or fracture zones, which may affect the movement of water or other fluids through rocks. The linear features are classified as to length--less than 30 mi/mg and more than 30 mi/mg. (USGS)
W88-03417

LINEAR FEATURES DETERMINED FROM LANDSAT IMAGERY IN WESTERN KANSAS,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. E. Cooley.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 84-241, 1984. 1 sheet (map), 1 fig, 5 ref.

Descriptors: *Remote sensing, *Kansas, *Maps, *Linear trends, *High Plains, *Ogallala aquifer, *Landsat imagery, Satellite technology, Geologic faults, Geologic joints, Regional Aquifer System Analysis, Geohydrology.

A map (scale 1:500,000) shows the linear features determined from Landsat imagery in western Kansas. The linear features, sometimes called linear trends or lineaments, are not identified as to type or origin. Most probably represent fractures or fracture zones, which may affect the movement of water or other fluids through the rocks. The linear features are classified as to length--less than 30 miles and more than 30 miles. (USGS)
W88-03418

WATER RESOURCES OF HUGHES COUNTY, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03420

ALTITUDE AND CONFIGURATION OF THE WATER TABLE, AND DEPTH TO WATER NEAR CHEYENNE, WYOMING, MAY 1984,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03421

FLOOD OF SEPTEMBER 12-13, 1982 IN GIBSON, CARROLL, AND MADISON COUNTIES, WEST TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03423

POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER SYSTEM IN THE SUWANNEE RIVER WATER MANAGEMENT DISTRICT, FLORIDA, MAY 1985,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03431

POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER SYSTEM IN THE NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT, FLORIDA, MAY 1985,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03436

RECONNAISSANCE OF THE WATER RESOURCES OF THE HOH INDIAN RESERVATION AND THE HOH RIVER BASIN, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03441

WATER RESOURCES OF WESTON COUNTY, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03442

HYDROLOGY OF LAKE BUTLER, ORANGE COUNTY, FLORIDA,
Geological Survey, Orlando, FL. Water Resources Div.
J. L. Smoot, and D. M. Schiffer.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4163, 1985. 1 sheet (map), 9 fig, 3 tab, 16 ref.

Descriptors: *Maps, *Lakes, *Water quality, *Lake levels, *Florida, Aquifers, Rainfall, Evaporation, Groundwater, Butler chain of lakes, Orange County, South Florida Water Management.

Lake Butler is one of the lakes that collectively make up the Butler chain of lakes in the headwaters of the Kissimmee River, Florida. The bottom configuration of the lake is typical of relict karst features formed during lower stages in sea level. The top of the Floridan aquifer is 50 to 100 feet below the land surface. The drainage area of Lake Butler is approximately 14.5 sq mi and is comprised of sub-basins of other lakes in the vicinity. Surface outflow from Lake Butler is generally southward to Cypress Creek, a tributary of the Kissimmee River. The extremes in lake stage for the period 1933-81 are 94.67 ft on June 23, 1981 and 101.78 ft on September 13, 1960. The median lake stage for this period was 99.28 ft above sea level. The quality of water in Lake Butler is excellent, based on studies of physical, chemical, and biological conditions by the Orange County Pollution Control Department. The lake water is slightly acidic and soft (48 mg/L hardness as calcium carbonate). Pesticides in water were below detection levels at two sites sampled in the lake, but were detected in the bottom sediments. (USGS)
W88-03448

HYDROGEOLOGIC AND WATER-QUALITY CHARACTERISTICS OF THE ST. PETER AQUIFER, SOUTHEASTERN MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
J. F. Ruhl, R. J. Wolf, and D. G. Adolphson.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 83-4200, 1983. 2 sheets (map), 14 fig, 2 tab, 14 ref.

Descriptors: *Aquifer characteristics, *Maps, *Water quality, *Underground waste disposal, *Minnesota, Hydrogeology, Geohydrology, Hollandale embayment, St. Peter aquifer.

Water quality in the St. Peter aquifer generally is suitable for most uses. Dissolved solids concentrations range from about 200 to 950 mg/L, with highest concentrations in the southwest where overlying Cretaceous deposits are a source of highly mineralized leakage. The aquifer is well protected from surface sources of contaminants except locally along the east side of the area where the overlying drift is less than 50 ft thick. The Decorah-Platteville-Glenwood confining bed overlies about 80% of the St. Peter, and drift overlies the remainder. Water in the St. Peter aquifer generally flows toward the Mississippi River and its tributaries. Some of the water flows southward into Iowa from a groundwater divide in Dodge and Steele Counties. Well yields from the aquifer are generally adequate for most uses. The aquifer is part of a sequence of sedimentary bedrock units that was deposited in Paleozoic seas that occupied a shallow depression known as the Hollandale embayment. The aquifer, which consists of light yellow or white, fine- to medium-grained, well-sorted sandstone, ranges from about 100 to 150 ft in thickness. (USGS)
W88-03456

HYDROLOGY OF LAKE PLACID AND ADJACENT AREA, HIGHLANDS COUNTY, FLORIDA,
Geological Survey, Tampa, FL. Water Resources Div.
D. B. Adams, and Y. E. Stoker.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4149, 1985. 1 sheet (map), 16 fig, 6 tab, 34 ref.

Descriptors: *Lakes, *Maps, *Limnology, *Surface-groundwater relations, *Florida, Water quality, Bathymetry, Groundwater movement, Aquifers, Highlands County, Highlands Ridge.

The study conducted during 1982-83, documents hydrologic conditions in Lake Placid and surrounding areas of Florida. Lake-stage data indicate that the 2- to 50-year flood stage ranges from 93.9 to 96.2 ft. Lake stage is reflected by annual departure of precipitation of the previous year from long-term average. A bathymetric map at 5 ft intervals indicates sinks in the lake bottom. Maximum depth and volume were 54 ft and more than 85,000 acre-feet, respectively. Lake Placid is a surface expression of the water table surficial aquifer with normal flow direction from south to north. Above average amounts of precipitation during winter 1983 created a groundwater mound north of Mirror Lake that caused reversal of the groundwater gradient in the water table aquifer. Lake water is neutral to slightly acidic, with low alkalinity and salinity. Nutrient concentrations are low and remain constant since 1966. Water samples collected since 1966 show trends toward increasing ionic composition and dissolved solids. Organic, inorganic, and phytoplankton analyses show Lake Placid to be relatively clear and clean. (USGS)
W88-03470

LOW FLOWS AND FLOW DURATION OF TENNESSEE STREAMS THROUGH 1981,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2E.
W88-03471

ASSESSMENT AND COMPILATION OF GROUND-WATER QUALITY DATA FOR MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
G. F. Mitchell.
Available from the National Technical Information Service, Springfield, VA 22161, as PB87-159463/AS. Price codes: A02 in paper copy, A01 in microfiche. Mississippi Water Resources Research Institute, Mississippi State. Technical Interim Report G1026-23, July 1986. 8 p. Contract No. 14-08-0001-G1026. Project No. USGS G1026-23.

Descriptors: *Water quality data, *Groundwater management, *Mississippi, *Groundwater data, *Groundwater quality, Management, Planning.

A compendium of groundwater quality data was derived from the files of specific agencies in the State of Mississippi that are linked with well site identification data. Dissemination of the data will be in the form of tables and graphs. This is to be accomplished by assessing and compiling groundwater quality data from the Mississippi State Board of Health (BOH) and USGS and then merging the data with well site identification data also developed by the USGS. To date, BOH data has been compiled for nearly thirty percent of the Mississippi counties, and programs have been developed to store, read and update the created files. Tapes of water quality and well site identification data have been secured from the USGS, and programs have been developed to read selected data from these tapes, which is then merged with the BOH data into one file. A program, called SURFACE II, is then employed to disseminate graphical output of selected water quality parameters in selected counties for specific aquifers. In conjunction with this effort, a survey of the other states was conducted to assess the status of water resource data management across the U.S. The survey is complete, achieving a 92% return, and all results have been compiled. These will be used for planning for future water resources data management. (Mitchell-Mississippi State Univ.)
W88-03485

8. ENGINEERING WORKS

8A. Structures

USE OF ANTI-TURBIDITY CURTAINS AT A SAND COMPACTION PILING AREA IN YOKOHAMA HARBOUR,
Japan Bottom Sediment Management Association, Tokyo.
For primary bibliographic entry see Field 5G.
W88-02532

PROCEEDINGS OF REMR WORKSHOP ON ASSESSMENT OF THE STABILTY OF CONCRETE STRUCTURES ON ROCK.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Structures Lab.
For primary bibliographic entry see Field 8E.
W88-02590

USE OF ROCK ANCHORS TO IMPROVE STABILITY OF STRUCTURES WITHIN THE OHIO RIVER DIVISION,
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 8E.
W88-02591

SUMMARY OF EXPERIENCES, PROBLEMS, AND NEEDS OF NORTH CENTRAL DIVISION,
Corps of Engineers, Chicago, IL. North Central Div.
For primary bibliographic entry see Field 8E.
W88-02592

STABILITY ANALYSIS OF TROY LOCK AND DAM,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Structures Lab.
C. Pace.
IN: Proceedings of REMR Workshop on Assessment of the Stability of Concrete Structures on Rock, September 10-12, 1985. Final Report, January 1987. p 27-35, 7 fig.

Descriptors: *Dam stability, *Concrete dams, *Stability analysis, *Dam foundations, *Dam failure, Locks, Concrete technology, Rock testing, Concrete testing, Concrete construction, Materials testing, Rock testing, Stress analysis.

The New York District of the U. S. Army Corps of Engineers conducted a stability analysis of the Troy Lock and Dam to determine what rehabilitation should be performed. The first phase of the study consisted of a condition survey where cracks were mapped, soniscope and impact hammer measurements were taken, construction drawings were reviewed, and operation and maintenance problems were discussed. From the first phase of the study, it was concluded that internal cracking in the lock and dam was structurally insignificant and that the interior concrete was probably in sound condition. The second phase of the study involved a coring program, testing and evaluation of the cores, stability analysis, and stress analysis. The compressive strength of the foundation material was found to be weaker than the concrete at the structure-foundation interface. The irregularities at the interface of the structure and foundation could not be determined. The effects of vibrations and eccentric loading on shear resistance, uplift forces on the structure, and backfill pressures on the landside lockwall were also not known. The stability analysis indicated that some landwall monoliths of the lock did not meet the criteria for overturning and a lot of the lock and dam monoliths did not meet the sliding stability criteria. Reaction blocks and posttensioning were designed to add additional stability to those monoliths. (See also W88-02590) (Geiger-PTT)
W88-02594

REVIEW OF METHODS OF ANALYZING THE STABILTY OF CONCRETE STRUCTURES ON ROCK FOUNDATIONS,
For primary bibliographic entry see Field 8E.
W88-02595

TVA ASSESSMENT OF STABILITY OF CONCRETE STRUCTURES ON ROCK,
Tennessee Valley Authority, Knoxville.
H. Buttrey, and H. Deal.
IN: Proceedings of REMR Workshop on Assessment of the Stability of Concrete Structures on Rock, September 10-12, 1985. Final Report, January 1987. p 41-53, 7 fig.

Descriptors: *Dam stability, *Rock testing, *Concrete construction, *Stability analysis, *Concrete testing, Concrete dams, Rock mechanics, Materials testing, Structural engineering, Dam foundations, Dam design, Materials engineering, Maximum probable floods, Uplift pressure.

The Tennessee Valley Authority (TVA) is responsible for the maintenance and stability analysis of several dams in a seven state area in the Southeastesn United States. Since the mid-1960's, the TVA has used the maximum probable flood as the design flood and the probable maximum flood to set dam freeboard and spillway containment wall heights. Other criteria developed for each site are the operating basis earthquake and the maximum credible earthquake. The safety reevaluations that were used for most of the original designs are reviewed. Base stress criteria are discussed in terms of compression on the rock foundation and concrete, and tension load for dead loads, horizontal loads and normal loads. For most of TVA's dams on rock foundation, means for measuring uplift pressures were installed during initial construction or have been added later. Several assumptions that had to be made for the purposes of monitoring uplift in dams and locks are examined. An extensive geologic exploration program was carried out on the foundations of all dams TVA has designed and constructed on a rock foundation. TVA still uses the shear friction method for determining resistance to sliding for structures on a rock foundation. TVA has the facilities to extract and test rock cores to determine strength parameters of any weak areas. Such tests were performed on the Tims Ford Dam, a rockfill dam in Middle Tennessee constructed in the mid-1960's. Results of the testing program led to the conclusion that the stability analysis of the dam should be done for two sets of strength parameters for the weak seams. (See also W88-02590) (Geiger-PTT)
W88-02596

BUREAU OF RECLAMATION CURRENT PRACTICES OF CONCRETE STRUCTURES ON ROCK FOUNDATIONS,
Bureau of Reclamation, Washington, DC.
H. Boggs.
IN: Proceedings of REMR Workshop on Assessment of the Stability of Concrete Structures on Rock, September 10-12, 1985. Final Report, January 1987. p 54-61.

Descriptors: *Rock testing, *Concrete testing, *Concrete dams, *Stability analysis, *Design criteria, Concrete construction, Rock mechanics, Structural engineering, Materials testing, Dam foundations, Gravity dams, Concrete dams, Safety, Stress analysis, Weirs, Uplift, Maintenance.

The Bureau of Reclamation is currently in the process of rewriting criteria and preparing design standards and guidelines for concrete dams. Similar criteria is in existence for retaining walls. Criteria differs for gravity or arch dams and for new or existing structures. The Safety factors for both stress and sliding stability arch and gravity structures are listed. Currently, foundation analyses include the sliding friction (or the Coulomb equation) and applicability of the passive wedge analyses. Criteria for stability analysis of usual, unusual and extreme loads are discussed. Stress analyses for the gravity dam or the arch dam use the ordinary beam theory or the finite element method. Also used for the arch dam is the trial load method or the computerized version called Arch Dam Stress Analyses System. In the foundation, primary analyses are the shear friction factor of safety, passive wedge analyses, and some of the progressive failure modes where appropriate. Instrumentation used in structural analysis and maintenance procedures are discussed. Current Bureau research on concrete dams include the development of a contraction joint finite element code for the ADINA computer program, the application of fracture mechanics to concrete dams, and a project to determine the effectiveness of foundation grouting during construction. (See also W88-02590) (Geiger-PTT)
W88-02597

FEDERAL ENERGY REGULATORY COMMISSION DAM SAFETY PROGRAM,
Federal Energy Regulatory Commission, Washington, DC.
J. Foster.
IN: Proceedings of REMR Workshop on Assessment of the Stability of Concrete Structures on Rock, September 10-12, 1985. Final Report, January 1987. p 62-88, 12 fig, append.

Descriptors: *Dam stability, *Stability analysis, *Concrete construction, *Safety, *Dam foundations, Rock testing, Concrete testing, Rock mechanics, Structural engineering, Gravity dams, Case studies, Dam construction.

The Federal Energy Regulatory Commission (FERC), Office of Hydropower Licensing is responsible for the dam safety program. The program is administered in two ways. All structures must be certified to be safe before licensing. After licensing, each project is inspected annually by FERC Regional Office inspectors, and once every 5 yr by independent consultants. The dam safety program has been successful in identifying potentially unsafe and hazardous dams. FERC has required over 50 dams to undergo varying degrees of rehabilitation in the past 5 yr. Unsafe dams usually fall into two general categories: either the safety criteria or analysis procedures have changed since the dam was designed and constructed; or deterioration of the structure (or foundation) required a reassessment of its safety based on current site conditions. The basic requirements for the stability analysis of dams under various conditions are considered. Three examples of rehabilitated concrete gravity dams are discussed. The Elwha Dam near Port Angeles, Washington experienced leakage. Remedial measures resulted in a large amount of materials being placed on the upstream face to form an impervious blanket. Remedial measures approved by FERC involved installation of 20 multistrand, high strength steel tendons in the gravity section and spillway piers. Rehabilitation of the Claytor Dam, in Radford, Virginia included posttensioning of a weak plane in the right nonoverflow abutment and the installation of reinforced concrete thrust blocks at both abutments. In addition, rock downstream of both abutments was grouted and capped with concrete to prevent unraveling during overtopping of the structure. The Barker Dam near Boulder, Colorado was repaired by vertical anchors along the crest of the dam and along the downstream face. Areas of additional research to ensure the safety of gravity dams are discussed. (See also W88-02590) (Geiger-PTT)
W88-02598

COMPUTER CODES AVAILABLE TO ASSIST IN STABILITY ANALYSIS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
N. Radhakrishnan.
IN: Proceedings of REMR Workshop on Assessment of the Stability of Concrete Structures on Rock, September 10-12, 1985. Final Report, January 1987. p 89-122, 25 fig.

Descriptors: *Stability analysis, *Computer programs, *Structural engineering, *Design criteria, *Concrete construction, Rock testing, Concrete testing, Materials testing, Concrete dams, Gravity dams, Dam stability, Locks, Computer models.

The Three-Dimensional Stability Analysis/Design Program was developed under the Computer-Aided Structural Engineering project for the analysis and design of hydraulic structures with respect to overturning, sliding, and maximum bearing. The program has two modes of operation: general structural capabilities, and specific structure types. The general modules allow the user to create and interactively plot the geometry and loads of the structure, obtain volumes, weights, centroids, forces, and moments for these, and then do an analysis to determine if the base pressures, area of base in compression, sliding, and maximum bearing are at acceptable values. A Free-Body Module also exists to clip the geometry and loads to detemine a new problem and make the subsequent analysis. The specific structure modules (currently dams and gravity locks) start with certain predetermined shapes and allows the user to give specific values for the parameters for these pieces. The general geometry, loads, and analysis data are then automatically generated for the user. Specific load cases are preprogrammed in the specific structures modules. A Design Memorandum plate capability is also available for dams. The program has been used by several Corps of Engineers District offices on a variety of projects such as Lock and Dams 2 and 26 by the St. Louis District, Richard B. Russell Dam by the Mobile District, and Chief Joseph Dam by the Seattle District. (See also W88-02590) (Geiger-PTT)
W88-02599

DETECTION AND MONITORING OF STRUCTURAL DEFICIENCIES IN THE ROCK FOUNDATION OF LARGE DAMS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
K. Kovari.
IN: Proceedings of REMR Workshop on Assessment of the Stability of Concrete Structures on Rock, September 10-12, 1985. Final Report, January 1987. p 123-126.

Descriptors: *Dam stability, *Dam foundations, *Rock testing, *Concrete testing, *Stability analysis, Concrete construction, Rock mechanics, Deformation, Monitoring, Structural engineering, Boreholes, Gravity dams, Arch dams, Materials testing.

To judge the safety of a structure, deformation measurements are usually carried out. Considering present-day numerical methods in analysis and design of dams and also the advanced construction technology and materials used, the major source of uncertainty in predicting the behavior and safety of dams, large and small, mainly resides in the actual rock mass properties and behavior. It is common to continuously monitor the structure and its foundation throughout its service life. Deformation monitoring of dams and their foundations is carried out to check normal behavior, to allow early recognition of deviations, and to find the cause of unexpected behavior. Generally, only a very few displacement vector components from selected points on the structure or in boreholes will be achieved by standard instrumentation programs. Line-wise observation, along with high precision instrumentation, will supply a larger and more meaningful amount of information. Measurement schemes directed towards the differential of axial displacements or axial strain would provide more meaningful measurements of displacement in terms of localization of measurements and available quantities of data points. The borehole micrometer can measure axial strain of the borehole with an accuracy of .000003. This is sufficient accuracy for stress measurements to the nearest 150 psi in typical rocks, or for detection of very minute rock joint openings as overlying structures are loaded. At the Kolnbrein arch dam in the Austrian Alps, subsurface rock strain measurements indicated not only a change in deformation magnitudes with increasing water levels, but also a major redistribution of stresses in the foundation rock. Th Albigna gravity dam in the Swiss Alps demonstrated cracks in several monoliths that propagated down into the rock foundation. Remedial grouting to stop the underseepage through the pair of opening joints was performed. The concepts of measuring strains directly in in situ rock as opposed to simply measuring displacements are discussed. (See also W88-02590) (Geiger-PTT)
W88-02600

COMMENTS ON A PROPOSED INVESTIGATION OF LATERAL EARTH PRESSURES EXERTED BY BACKFILLS,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
W. Clough.
IN: Proceedings of REMR Workshop on Assessment of the Stability of Concrete Structures on Rock, September 10-12, 1985. Final Report, January 1987. p 128-137, 9 ref.

Descriptors: *Stability analysis, *Backfill, *Earthworks, *Earth pressure, *Soil mechanics, Structural engineering, Monitoring, Boreholes, Rock testing, Navigation, Pressure-measuring instruments.

The rehabilitation of navigation structures requires consideration of the lateral earth pressures acting upon the structure. To achieve the objective of an improved earth pressure prediction technology, studies along several different lines are required: measurements of lateral backfill pressures; studies of lateral pressures using reasonably sized laboratory model systems; and, analytical studies of full-sized navigation structures using modern finite element technology. In measuring earth pressures acting on existing structures, tests may be performed in the backfill near the structure with active in situ test instruments, passive instruments may be placed in the backfill, or lateral pressures may be measured in structures where earth pressure cells are already installed. Active in situ devices for backfill tests include the pressuremeter and the Marchetti dilatometer. Examples of passive type instruments for backfill tests are the Gloetzl cell, the Camkometer, and the lateral-stress cone. Earth pressure cells embedded in the walls of retaining structures have been used on a numnber of occasions to measure lateral stresses. Field trials of the candidate probes might well be carried out at a site where a navigation structure has operating earth pressure cells to provide a prototype check on the capability of any device to measure the earth pressures acting on the structure. (See also W88-02590) (Geiger-PTT)
W88-02601

DESIGN OF THE MISICUNI SCHEME IN BOLIVIA,
Electrowatt Engineering Services Ltd., Zurich (Switzerland).
H.-E. Minor, I. D. Clarke, and W. Riemer.
International Water Power and Dam Construction IWPCDM, Vol. 39, No. 7, p 13-18, July 1987. 3 fig, 3 tab, 7 ref.

Descriptors: *Misicuni project, *Bolivia, *Water resources development, *Dams, *Hydroelectric power, Geology, Optimization.

Tender designs have recently been completed for the Misicuni multipurpose project, which will supply drinking and irrigation water to the Cochabamba region of central Bolivia, as well as producing almost 500 GWh/year of hydroelectricity. Much of the project area as remote and at high altitude, with consequent problems of access and logistics, in particular for field investigations. This article defines the final concept of the scheme, describes a number of aspects of detailed design, and also mentions the optimization calculations. Largely as a result of the closer evaluation of geological conditions, a number of important changes had to be made to the project concept recommended in earlier studies, and the reasons for these changes are discussed in full. (Author's abstract)
W88-02697

FRANCIS TURBINES FOR THE TUCURUI POWERPLANT,
Neyrpic, Grenoble (France).
For primary bibliographic entry see Field 8C.
W88-02698

PIPELINE INSTALLATION USING DIRECTIONALLY CONTROLLED DRILLING,
Reading and Bates Horizontal Drilling Co., Tulsa, OK.
J. D. Hair, and G. E. Shiers.
Public Works PUWOAH, Vol. 118, No. 6, p 73-75,113, June 1987. 3 fig.

Descriptors: *Pipelines, *Hydraulic structures, *Conveyance structures, *Construction methods, *Horizontal drilling, Construction, Design criteria, Drilling, Drill equipment.

The horizontally drilled, directionally controlled method of installing pipelines across rivers is an attractive alternative to conventional techniques especially at difficult river crossing sites. Horizontally drilled river crossings offer the designer the security of deep river bed cover with minimal environmental damage and no disruption of river traffic. Concrete weightcoating is unnecessary and the crossing is installed in weeks rather than months. The pipeline installation method was detailed and significant adaptations were discussed. Crossing lengths slightly less than a mile have been achieved by this method; the largest pipe diameter installed was 40 inches. (Wood-PTT)
W88-02809

ENVIRONMENTAL IMPACT ANALYSIS OF THE SARYU CANAL IRRIGATION PROJECT AND GUIDELINES FOR ITS MANAGEMENT,
M.L.K. Coll., Balrampur (India).
For primary bibliographic entry see Field 6G.
W88-02863

GROUND-WATER DAMS FOR RURAL WATER SUPPLY IN DEVELOPING COUNTRIES,
Royal Inst. of Tech., Stockholm (Sweden). Institutionen foer Kulturteknik.
A. Nilsson.
Trita-Kut 1034, Research Report. March 1984. 56 p, 70 fig, 5 tab, 74 ref.

Descriptors: *Hydraulic structures, *Dams, *Water storage, Groundwater dams, Sand dams, Subsurface dams, Developing countries, Rural areas, Arid lands, Aquifers, Environmental effects, Water conservation, Storage, Sediments, Seepage control.

Simple, inexpensive groundwater dams are suitable for storing water in developing countries. Two types are defined. The subsurface type, constructed below ground level, traps water in a natural aquifer. A sand dam impounds water in sediments accumulated within the dam. Groundwater dams are found throughout the world, especially in areas of low rainfall and high evaporation. Subsurface dams are often built in river beds; shallow residual soil aquifers may also be suitable. Typical construction materials are clay, concrete, stone, brick, ferroconcrete, and polyethylene or tarfelt sheets. Sand dams are built where suitable sediments can be deposited. They are often constructed with concrete, stone, gabions, or blocks with clay layers. Water is extracted from groundwater dams by large-diameter wells or by gravity. Seepage losses and erosion can be minimized by proper connection of the dams to impermeable rock or unconsolidated layers. Although environmental impact of these dams is low, it is possible to experience upstream waterlogging, disturbances in downstream flow, pollution caused by higher groundwater levels, and salt accumulation. (Cassar-PTT)
W88-02924

USE OF GEOMEMBRANES IN ITALIAN DAMS,
Centro di Ricerca Idraulica e Strutturale, Milan (Italy).
For primary bibliographic entry see Field 8G.
W88-03200

TRIPLE USE OF A GEOTEXTILE AT AIT CHOUARIT,
Dumez S.A., Nanterre (France).
For primary bibliographic entry see Field 8G.
W88-03201

DEVELOPMENTS IN GEOCOMPOSITE RESEARCH IN THE GDR,
VEB Spezialbaukombinat Wasserbau, Weimer (German D.R.)
For primary bibliographic entry see Field 8G.
W88-03202

RECENT APPLICATIONS OF GEOTEXTILE FILTERS IN CHINA,
Nanjing Hydrological Research Inst. (China).
For primary bibliographic entry see Field 8G.
W88-03203

SHAPE OPTIMIZATION OF ARCH DAMS,
Institute of Water Conservancy and Hydroelectric Power Research, Beijing (China).
Z. Bofang.
Water Power and Dam Construction, Vol. 39, No. 3, p 43-48, 51, March 1987. 5 fig, 13 ref.

Descriptors: *Arch dams, *Dam design, *Optimization, *Mathematical models, *China, Dams, Engineering, Hydraulic engineering, Model studies, Hydraulic structures, Case studies, Structural engineering.

Mathematical models and solution methods are presented for the shape optimization of arch dams in China. Geometric models of 5-centered double curvature and parabolic double-curvature arch dams are considered, introducing a method of obtaining some different geometric models by the reduction of design variables. In the optimization process, in addition to the complicated stress analysis, not only does the geometric shape change frequently, but the position of the dam axis shifts and turns repeatedly, leading to a rather complicated shape optimization. The method of linearizing

internal force, the method of optimizing in two stages, and the mixed method of optimization are proposed. These methods effectively realize the optimum design of arch dams with high-speed computing, which is more rapid than the method of sequential linear programming used heretofore. The shape optimization of arch dams has been applied to specific projects in China, resulting in savings in dam volumes and considerable reductions in costs. (Doria-PTT)
W88-03205

MINGHU: TAIWAN'S FIRST PUMPED-STORAGE PROJECT,
Taipower, Shuili (Taiwan).
For primary bibliographic entry see Field 8C.
W88-03218

HEADRACE TUNNEL FOR THE CHIXOY SCHEME, GUATEMALA,
Motor-Columbus Ingenieurunternehmung A.G., Baden (Switzerland).
M. Gysel.
Water Power and Dam Construction, Vol. 39, No. 2, p 19-24 February 1987. 7 fig, 5 ref.

Descriptors: *Tunnels, *Guatemala, *Hydraulic design, *Tunnel construction, Geology, Engineering, Hydraulic engineering, Construction, Construction materials, Construction methods, Grouting, Drainage.

The 26 km-long headrace tunnel of the Chixoy powerplant in Guatemala is described. The power tunnel is in two sections, each passing through a mountain range. A fixed cone valve was provided at the southern end of the low point of the upper part of the tunnel to permit emptying the tunnel for periodic inspections. A ventilation duct was embedded in the tunnel invert to let out trapped air from the high-point area during tunnel filling and to provide air from outside during tunnel emptying to avoid negative pressures at the high point. Topics discussed in detail include tunnel geology, geotechnical tests conducted, tunnel design including static design methods, and tunnel construction. The headrace tunnel also includes a number of additional structures, such as the intake structure, the Agua Blanca pipe bridge over the Chixoy River, the Pampur karstic spring catchment, a surge chamber system, and a butterfly valve chamber. Commercial operation began in March/April 1986 after a six-month test phase. Periodic water level measurements taken in the intake and surge chamber shaft (with closed intake gate and valve at the end of the tunnel) show that the balance of water inflows into the tunnel and probable losses have remained unchanged, indicating normal performance of the headrace tunnel. (Doria-PTT)
W88-03219

TRANSIENT MIXED FLOW IN GALLERIES AND CONDUITS OF HYDRO PLANTS,
Hydraulic Engineering Research Inst., Bucharest (Romania).
For primary bibliographic entry see Field 8B.
W88-03220

DETERMINING DIAMETERS OF POWER TUNNELS AND PRESSURE SHAFTS,
Morrison-Knudsen Engineers, Inc., San Francisco, CA.
F. Fahlbusch.
Water Power and Dam Construction, Vol. 39, No. 2, p 41-52 February. 4 tab, 5 ref.

Descriptors: *Tunnels, *Pressure conduits, *Hydraulic geometry, *Mathematical equations, *Economic aspects, *Pumped storage, *Hydroelectric plants, Conduits, Powerplants, Storage, Hydraulic design, Hydraulic structures, Penstocks, Optimization, Computers, Model studies, Cost analysis, Mathematical studies, Mathematical analysis.

Two empirical formulae for the economical diameter of conduits are presented which hold for both conventional and pumped-storage powerplants. The first formula is for concrete-lined power tunnels and pressure shafts, and the second applies to steel-lined pressure shafts. The formulae, based on the analysis of 394 conduits, require knowledge of only the design discharge and head to determine the diameters. Whether the empirical formulae are applicable to a specific situation needs to be examined on a case-by-case basis. The formulae are adequate for preliminary purposes, comparative analyses, and plan formulation studies. At more advanced stages, the decision may be more difficult, requiring consideration of the conduit cost in relation to the total project cost and the economic consequences that may result from an over- or under-designed tunnel or shaft. (Doria-PTT)
W88-03222

8B. Hydraulics

BANK PROTECTION, BASS LOCATION, WILLAMETTE RIVER, OREGON: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
R. A. McCollum, C. W. O'Neal, and J. E. Glover.
Available from the National Technical Information Service, Springfield, VA. 22161. Technical Report HL-87-7, May 1987. Final Report. 30 p, 2 fig, 2 tab, 15 ref.

Descriptors: *Bank protection, *Willamette River, *Oregon, *Hydraulic models, *Model studies, Erosion, Flow velocity, Groins, Flow control.

The Bass Location, Willamette River, is located between river miles 137 and 135, just southeast of Corvallis, Oregon. This area is subject to severe bank erosion during the high-water months of each year. The model study was conducted to look at the alternative of using stone groins as a method of bank protection instead of blanket stone revetment. This method was favored due to studies indicating that stone groins provide a more favorable habitat for river microorganisms and fish than does blanket revetment. The model, built to a horizontal scale of 1 to 100 and a vertical scale of 1 to 50, had both a movable bed and bank line. The study considered two conditions: (1) Installation of eight groins in the right bank below the Bass Phase I revetment; and (2) Installation of the groins plus closing of the right channel at river mile 136.7. Results of the study indicate that: (1) Installation of the eight groins below the Bass Phase I revetment will greatly reduce the erosion of the bank line and cause no significant increase of velocities in the channel; and (2) Installations of the groins plus closing of the right channel at river mile 136.7 will reduce the erosion of the right bank, but not to the extent that groins without the right channel closure would. Velocities on the bank opposite the groins increased enough to cause concern for erosion of the left bank. (See also W88-02533) (Author's abstract)
W88-02562

HYDROFRACTURING OF WATER WELLS,
Baski Water Instruments, Inc., Denver, CO.
For primary bibliographic entry see Field 8C.
W88-02803

HYDRAULICS OF HORIZONTAL SHAFT OXIDATION DITCHES,
Gutteridge, Haskins and Davey Pty Ltd., Brisbane (Australia).
For primary bibliographic entry see Field 5D.
W88-02845

CACHE RIVER PUMPING STATION, SOUTH OF MOUND CITY, ILLINOIS: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
E. D. Rothwell, and B. P. Fletcher.
Available from the National Technical Information Services, Springfield, VA 22161. Technical Report HL-82-1, January 1982. Final Report. 39 p, 8 fig, 3 tab, 11 photos, 8 plates.

Descriptors: *Hydraulic structures, *Sumps, *Pumping plants, Model studies, Hydraulic models, Cache River pumping station, Illinois, Riprap, Protection, Flow characteristics.

Hydraulic model studies at 1:10 scale showed that satisfactory sump performance was indicated for all anticipated water-surface elevations with either single or multiple pump operations. Hydraulic performance was the same with the suction bell located 0.33 and 0.80 of the diameter of the suction bell above the floor of the sump. Adverse sump performance was not evident until the water surface was lowered 3 ft below the anticipated minimum. Results also showed that the approach wing walls to the sump could be constructed of concrete as originally designed or of sheet piling. The minimum riprap gradation (12-inches thick, maximum stone weight of 86 pounds) was considered adequate to protect the approach for all anticipated pumping conditions. (Cassar-PTT)
W88-02935

EVALUATION OF PHYSICAL AND NUMERICAL HYDRAULIC MODELS, MASONBORO INLET, NORTH CAROLINA,
Coastal Engineering Research Center, Fort Belvoir, VA.
J. E. McTamany.
GITI Report 22, February 1982. 51 p, 17 fig, 13 tab, 13 ref, append.

Descriptors: *Hydraulics, *Model studies, *Inlets, *Waves, Hydraulic models, Mathematical models, Masonboro Inlet, North Carolina, Water level, Tidal hydraulics, Flow characteristics, Wind waves.

A fluidized-bed distorted-scale physical model, a two-dimensional vertically integrated numerical model, and a spatially integrated numerical model were calibrated to determine prototype conditions at Masonboro Inlet, North Carolina, in September 1969. Comparison of model results with prototype data showed that the physical model and the two-dimensional numerical model reproduced prototype conditions equally well. A second complete set of prototype data, including revised bathymetry was subsequently obtained at Masonboro Inlet in July 1974. After the bathymetry was updated, the models were run using the observed ocean tide as a forcing condition. The model predictions were then compared with prototype data without further recalibration. Both the physical and the two-dimensional numerical models reproduced observed tidal records and vertically averaged velocities equally well. No appreciable improvement in tidal height or velocity predictions was obtained by modeling prototype wind waves in the physical model. The waves caused a slight increase in bay water levels that also occurred in the prototype. Neither numerical model had the capability to model wind waves. The spatially integrated model only predicts the average bay water level and the inlet mean velocity time histories. The predictions from the other models and the prototype data were averaged for comparison with the spatially integrated model. The spatially integrated model did not predict the average bay levels as well as the other models; however, it did predict the mean inlet velocities significantly better than the other two models. (Author's abstract)
W88-02939

FIELD INSPECTION OF THE FISHER RIVER CHANNEL REALIGNMENT PROJECT NEAR LIBBY, MONTANA,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 4D.
W88-02941

TRANSIENT MIXED FLOW IN GALLERIES AND CONDUITS OF HYDRO PLANTS,
Hydraulic Engineering Research Inst., Bucharest (Romania).
V. Jeler, and I. Jelev.
Water Power and Dam Construction, Vol. 39, No. 2, p 27-30 February 1987. 8 ref.

Descriptors: *Unsteady flow, *Flow characteristics, *Hydroelectric plants, *Canals, *Pressure conduits, *Intakes, Hydraulics, Powerplants, Conduits, Engineering, Hydraulic engineering, Estimating equations, Mathematical studies, Fluid mechanics, Algorithms, Hydrodynamics, Wave propagation, Wave velocity.

A comparative analysis is presented of the basic equations for unsteady flow in canals and pressurized conduits, emphasizing the flow transformation and identification at the moment of transition from open to pressurized conditions, and vice versa. A program called PRES is developed for computing unsteady mixed flow. No special problems arose in solving the equations in the case of slow transition from open to pressurized flow and vice versa, providing the flow in the gallery is entirely pressurized or entirely in open conditions. A computation scheme adequate for the regime of rapid discharge and level variations of flow in the gallery must be used to avoid inaccurate results. The program established for the conditions described has been applied with good results for studies carried out on some hydraulic systems and galleries with either rectangular or circular cross-sections. (Doria-PTT)
W88-03220

THEORETICAL ASSESSMENT OF CASING STORAGE EFFECTS WHEN PUMP SAMPLING A PARTIALLY PENETRATING BOREHOLE,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Groundwater Research.
G. B. Davis.
Hydrological Sciences Journal HSJODN, Vol. 32, No. 2, p 133-141, June 1987. 1 fig, 3 tab, 12 ref.

Descriptors: *Well hydraulics, *Partially penetrating wells, *Groundwater, *Hydraulic models, *Pumping tests, *Model studies, Hydraulics, Well casings, Theoretical analysis, Wells, Test wells, Mathematical studies, Mathematical equations, Boreholes, Aquifers, Pumping, Drawdown, Laplace equation, Casings.

A borehole partially penetrating a confined aquifer and pumped at a constant rate is modelled, taking account of water stored within the casing of the borehole. A solution for drawdown in the Laplace transform domain is obtained. The proportion of aquifer water in well discharge is numerically evaluated, tabulated as a function of time, and compared with results for a fully penetrating well. Modification of the fully penetrating well theory, for application to partially penetrating wells, gives comparable results to the more complete analysis for a partially penetrating well both at early and late times. A previous estimate of the time of pumping before sampling to minimize casing storage effects, based on the fully penetrating well theory, was confirmed by the partially penetrating well analysis and in fact was shown to be a conservative estimate (or overestimate) of the pumping time required when sampling from a partially penetrating well. (Author's abstract)
W88-03273

MATHEMATICAL MODELING OF SEDIMENTATION EFFECTS ON WATER RESOURCES SYSTEMS,
Mississippi State Univ., Mississippi State. Center for Computational Hydroscience and Engineering.
For primary bibliographic entry see Field 2J.
W88-03492

8C. Hydraulic Machinery

DESIGN OF THE MISICUNI SCHEME IN BOLIVIA,
Electrowatt Engineering Services Ltd., Zurich (Switzerland).
For primary bibliographic entry see Field 8A.
W88-02697

FRANCIS TURBINES FOR THE TUCURUI POWERPLANT,
Neyrpic, Grenoble (France).
A. Sauron.
International Water Power and Dam Construction IWPCDM, Vol. 39, No. 7, p 21-26, July 1987. 6 fig, 2 tab, 6 ref.

Descriptors: *Turbines, *Tucurui project, *Brazil, *Water resources development, *Dams, *Hydroelectric power, Tocantins river, Energy.

The Tucurui hydroelectric powerplant is in the Brazilian state of Para, near the small town of Tucurui, 300 km from the capital, Belem. It will be the last powerplant to be provided on the Tocantins river, between Maraba town and the river mouth, near Belem. The Tocantins river, one of the tributaries of the Amazon, rises in the central plateau near Brasilia, at 1000 m above sea level, and runs for more than 2500 km from south to north. The river mouth is located near Belem where the river almost reaches sea level. Its drainage basin covers 767000 sq km. At the final state of its development by Eletronorte, the full capacity will be 8000 MW. The energy generated by Tucurui will mainly be used by the mining industries (Abras and Alunorte projects) using the resources of the Trombetas river. A significant amount of energy will also be distributed to several small towns to substitute hydropower energy for the costly thermal energy currently used in this area. (Author's abstract)
W88-02698

COMPUTERIZED HYDROPOWER PLANNING IN LATIN AMERICAN COUNTRIES,
SM-Latinamerica, Lima (Peru).
For primary bibliographic entry see Field 6A.
W88-02699

HYDROELECTRIC POWER IN COLOMBIA,
Ingetec S.A., Bogota (Colombia).
C. S. Ospina.
International Water Power and Dam Construction IWPCDM, Vol. 39, No. 7, p 33-38, July 1987. 6 fig.

Descriptors: *Water resources development, *Dams, *Hydroelectric power, Colombia, *Guavio project, Planning, Rivers, Networks.

At present 77 percent of Colombia's power generation is produced from hydro stations, and the priority for the future will be developing more of the country's abundant hydro resources. This article reviews the development of the Colombian hydro industry, discussing, for example, the impact of the country's interconnection system on the planning and construction of large schemes during the 1970s. A description is included of Guavio, the country's largest hydro scheme under construction at present, which will have a capacity of 1600 MW. (Author's abstract)
W88-02700

PROSPECTS FOR LARGE AND SMALL HYDRO DEVELOPMENT IN PERU,
P. Wicke.
International Water Power and Dam Construction IWPCDM, Vol. 39, No. 7, p 47-50, July 1987. 5 fig, 3 ref.

Descriptors: *Water resources development, *Dams, *Hydroelectric power, *Peru, Costs, Legal aspects, Energy, Planning, Rural areas.

Although a vast amount of hydro resources exist in the tropical regions of Peru, a number of financial and administrative problems are delaying the large-scale exploitation of this potential. Strategic energy planning has reached a crossroads, and although a number of large projects have been identified and studied in the country, emphasis is now turning to small hydropower, multipurpose schemes, and grid extensions for rural electrification. (Author's abstract)
W88-02701

LIMITS FOR PRESSURE TUNNELS WITHOUT STEEL LININGS,
Technische Univ. Muenchen (Germany, F.R.). Inst. for Hydraulic Engineering.
For primary bibliographic entry see Field 8E.
W88-02702

HYDROFRACTURING OF WATER WELLS,
Baski Water Instruments, Inc., Denver, CO.
H. Baski.
Water Well Journal WWJOA9, Vol. 41, No. 6, p 34-35, June 1987.

Descriptors: *Hydrofracturing, *Hydraulic machinery, *Well yield, *Well hydraulics, Water yield, Wells, Dry wells, High pressure, Pumps, Limiting factors.

The hydrofracturing process involves injecting high pressure water into the formation to increase the size and extent of existing fractures and to create new fractures thus increasing the formation permeability and well yield. Generally the components needed are: (1) a drill or pump rig with drill rod or high pressure pipe, or a reel with flexible high pressure hose to lower and raise the packer(s); (2) a source of clean water; (3) a pump with adequate pressure and volume delivery rate; (4) assorted valves gauges and fittings for controlling fluid injection and propping agent delivery; and (5) one or two inflatable packers with high pressure tubing and a supply unit for inflation. The packer string is lowered into position and the packers set in the well. Fluid is then pumped into the formation with or without a propping agent to keep the fractures open when the pressure is released. When the pumping is stopped, the pressure is released, the packer string is removed, and the well is tested to determine the increase in well yield. Equipment selection criteria and hints for successful hydrofracturing are presented. Hydrofracturing cannot improve wells under all circumstances; if there are many dry wells within a mile radius, the chances of increasing the yield by hydrofracturing are fewer. In cases where there is a 50-50 chance of drilling a good well, hydrofracturing may significantly improve well yield. (Wood-PTT)
W88-02803

REDUCING WATER PUMPING POWER COSTS,
Waxahachie Utilities Dept., TX.
T. Clark.
Public Works PUWOAH, Vol. 118, No. 6, p 89-90, June 1987. 3 fig.

Descriptors: *Pumping plants, *Pumping, *Economic aspects, *Cost analysis, *Electric power costs, *Costs, Operating costs, Evaluation, Electric power, Cost reduction.

The largest single expense of a local water utility company is that of electricity. Even water systems designed to run in an energy efficient manner must be operated efficiently by utility personnel. For a system to be operated efficiently, the operator must have data which will enable the development of pumping strategies that will ensure maximum economical operation of the system, which will reduce operating costs. Methods of acquiring the necessary data were presented and explained. Reducing power consumption during non-peak water consumption periods increased efficiency and resulted in cost savings. Specific suggestions for pump operation which minimized power consumption were given. When implementing a pumping power-reduction program, factors such as standby power, system dependability, industrial districts, ratios between high and low consumption levels, overall system design and capacities must be taken into consideration. System operation can be improved and costs reduced by developing a systematic program aimed at improving efficiency. (Wood-PTT)
W88-02812

SOME INVESTIGATIONS RELATING TO ENVIRONMENTAL IMPACTS OF A WATER RESOURCE PROJECT,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Industrial Engineering and Management.

For primary bibliographic entry see Field 6G.
W88-02864

TURBINE PERFORMANCE TEST: SPRING CREEK POWERPLANT UNIT NO. 2,
Water and Power Resources Service, Denver, CO. Engineering and Research Center.
A. E. Rickett, and A. B. Lewey.
Report No. HN-23, December 1983. 49 p, 9 fig, 6 tab, 5 append.

Descriptors: *Hydraulic equipment, *Turbines, *Flow measurement, Hydraulic machinery, Performance evaluation, Spring Creek Powerplant, Central Valley Project, California, Salt velocity method.

Performance of the vertical-shaft, Francis-type turbine at Spring Creek powerplant, Shasta County, California, was tested. The unit had a maximum efficiency of 92.96% at a discharge of 1774.4 cfs at a net head of 566 ft for a turbine output of 105,691 horsepower. The turbine discharge was determined by the Allen salt velocity method. (Cassar-PTT)
W88-02940

HYDROPOWER IN INDIA - AN ECONOMIC CASE STUDY,
Minor Irrigation Dept., Lucknow (India).
P. S. Nigam, and B. L. Jatana.
Water Power & Dam Construction, Vol. 39, No. 3, p 41-42, March 1987. 1 fig, 4 tab.

Descriptors: *India, *Hydroelectric power, *Electric power production, *Economic aspects, *Project planning, *Cost-benefit analysis, Environmental effects, Energy, Developing countries, Construction, Tunnels, Costs, Planning, Benefits.

A case study is presented on the economics of hydro-schemes in Uttar Pradesh, the largest state in India, having substantial hydro-potential and coal reserves. In a developing country like India, the energy demand far outstrips the available capacity, which often leads to the bulk of available capital being allocated for developing those energy sources that require the least time to implement. This often works to the disadvantage of hydropower, since such projects usually require longer construction periods compared to schemes generating power from fossil fuels. Topics discussed include energy resources of the area, performance of hydro schemes, project implementation time, and generation costs from hydro and thermal schemes. It is concluded that, to meet the demands of peaking power, there is no alternative to the development of the state's hydro resources, regardless of the development time required. Hydro projects also have an obvious advantage with increasing concern about pollution. Therefore, the development of Uttar Pradesh's hydro resources deserves the highest priority. (Doria-PTT)
W88-03204

MINGHU: TAIWAN'S FIRST PUMPED-STORAGE PROJECT,
Taipower, Shuili (Taiwan).
L. S. Yeh, C. Y. Kao, and F. L. Lin.
Water Power and Dam Construction, Vol. 39, No. 2, p 13-19 February 1987. 11 fig.

Descriptors: *Pumped storage, *Minghu, *Taiwan, *Utilities, *Hydraulic structures, *Economic aspects, *Electric power production, *Hydroelectric plants, Storage, Construction, Costs, Powerplants, Reservoirs, Geology, Hydrology, Tunnels, Turbines, Dams, Topography, Sedimentation, Penstocks.

The Minghu pumped-storage project, the first of its kind to be constructed in Taiwan, is described. The project, equipped with four 250 MW reversible units with a total capacity of 1,000 MW, is the largest hydro scheme undertaken by the Taiwan Power Company (Taipower). Construction was completed five months ahead of schedule, resulting in a considerable savings of the total construction cost. With the completion of this project, the reliability and flexibility of the entire national power grid has been improved, while unit power production has been considerably reduced. Subjects discussed include project description, topography, geology, hydrology, sedimentation, construction schedule, and the main features of the project, with descriptions of the intake, headrace tunnels, surge tanks, penstock, powerhouse cavern, transformer cavern, tailrace tunnels, lower reservoir dam, spillway, switchyard, control building, and debris dam. (Doria-PTT)
W88-03218

HEADRACE TUNNEL FOR THE CHIXOY SCHEME, GUATEMALA,
Motor-Columbus Ingenieurunternehmung A.G., Baden (Switzerland).
For primary bibliographic entry see Field 8A.
W88-03219

VERTICAL LIFT WHEEL GATES FOR SLUICEWAYS,
Ministry of Water Resources and Electric Power, Ziam City (China). Northwest China Hydropower and Design Inst.
Z. W. Zhong.
Water Power and Dam Construction, Vol. 39, No. 2, p 30-33 February 1987. 3 fig, 6 tab, 9 ref.

Descriptors: *Sluice gates, *Sluices, *China, *Hydroelectric plants, *Hydraulic structures, *Hydraulic machinery, On-site investigations, Spillway gates, Gates, Intake gates, Powerplants, Hydraulic design, Engineering, Hydraulic engineering.

The sluiceway gates at the Shiquan hydro project on the Hanjiang River, a tributary of the Yangtze River (China) are described. These vertical lift wheel gates have a span of 12 m, are suspended by cable from cranes, and can be closed by gravity under full flow. An emergency gate is located immediately upstream of the service gate. The emergency gate can be closed under full flow but cannot be opened under these conditions. It is used for emergency or maintenance closure. The top seal consists of three rows of J-type seals, set 1.5 m apart, which seal consecutively as the gate is raised. The gate leaf consists of a welded framework of built-up horizontal and vertical beams to support the skinplate. The gates were designed in the conventional manner, based on an approximate simplification of the structural behavior of the gates. Recommendations are made and further work suggested. (Author's abstract)
W88-03221

DETERMINING DIAMETERS OF POWER TUNNELS AND PRESSURE SHAFTS,
Morrison-Knudsen Engineers, Inc., San Francisco, CA.
For primary bibliographic entry see Field 8A.
W88-03222

8D. Soil Mechanics

COMMENTS ON A PROPOSED INVESTIGATION OF LATERAL EARTH PRESSURES EXERTED BY BACKFILLS,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
For primary bibliographic entry see Field 8A.
W88-02601

CONSTANT RATE OF LOADING CONSOLIDATION TEST,
Water and Power Resources Service, Denver, CO. Engineering and Research Center.
K. F. Fay, and C. E. Cotton.
REC-ERC-84-20, June 1984. 32 p, 8 fig, 2 tab, 12 ref, 2 append.

Descriptors: *Soil mechanics, *Soil compaction, *Load distribution, Compaction, Pore pressure, Clays, Soil tests.

For the past 50 years, the data used to estimate soil settlement characteristics has been obtained by the Bureau of Reclamation using a STD (standard incremental loading) consolidation test. Recently, several other test methods have been developed, among them the CRL (constant rate of loading) consolidation test. A versatile CRL apparatus developed by the Bureau, is described. Test results from the CRL apparatus are compared to results from a STD apparatus. The results show: (1) test completion times for the CRL test are much shorter than for the STD test; (2) agreement between the results of the CRL and STD tests are within reasonable limits, and (3) the CRL apparatus and test procedure offer an attractive alternative to the STD test. (Author's abstract)
W88-02947

EFFECTS OF GRAVITATIONAL AND EARTHQUAKE FORCES ON THE STABILITY OF THE SOUTH FORK CASTLE CREEK BLOCKAGE IN THE MOUNT ST. HELENS AREA, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
W. A. Meyer, M. A. Sabol, H. X. Glicken, and B. Voight.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Professional Paper 1345, 1985. 42 p, 25 fig, 5 tab, 24 ref.

Descriptors: *Slope stability, *Volcanoes, *Dam stability, *Mount St. Helens, *Washington, Avalanche, South Fork Castle Creek, Debris avalanches.

A slope stability analysis on the South Fork Castle Creek debris avalanche blockage, near Mount St. Helens, Washington, was conducted to determine the likelihood of mass failure of the blockage and resultant breakout of South Fork Castle Creek Lake. On the basis of material properties, groundwater levels, and seismic history of the blockage, slope stability with and without earthquake-induced forces was determined. Results indicated that the blockage will not fail from gravitational forces at September 1983 groundwater levels. An increase of 25 feet or more in water levels could cause local failures, but massive failure of the blockage is improbable. Blockage slopes are potentially unstable for present and higher water levels if an earthquake with magnitude greater than 6.0 should occur. Retrogressive slope failures are possible, but lowering of the blockage crest below lake level and consequent lake breakout are considered remote. Significant earthquake shaking could cause cracks in the blockage that might facilitate piping. (USGS)
W88-03108

8E. Rock Mechanics and Geology

PROCEEDINGS OF REMR WORKSHOP ON ASSESSMENT OF THE STABILTY OF CONCRETE STRUCTURES ON ROCK.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Structures Lab.
September 10-12, 1985. Final Report, January 1987. 303 p. Compiled by William F. McCleese.

Descriptors: *Dam stability, *Concrete construction, *Concrete technology, *Rock mechanics, *Materials testing, Monitoring, Design criteria, Materials engineering, Concrete additives, Concrete testing, Concretes, Concrete mixes, Concrete dams, Stability analysis, Rock testing, Rock properties.

The Workshop on Assessment of the Stability of Concrete Structures on Rock was conducted to define problems with the Corps' current stability criteria and procedures, and to identify research needs that would address these problems. The proceedings provide a summary of the papers presented and the activities, conclusions, and recommendations of five working groups. Each working group was assigned one of the following subject areas: shear strength selection procedures and the use of these parameters for evaluating the stability of existing concrete structures; foundation exploration procedures for acquiring test samples and

identifying weakness in the foundation for evaluating the staiblity of existing concrete structures; computation of forces and methods of analysis for evaluating the stability of existing concrete structures on rock; instrumentation and monitoring procedures for the purpose of evaluating the stability of existing concrete structures on rock; and procedures for selecting and designing systems to improve stability. (See W88-02591 thru W88-02601) (Author's abstract)
W88-02590

USE OF ROCK ANCHORS TO IMPROVE STABILITY OF STRUCTURES WITHIN THE OHIO RIVER DIVISION,
Army Engineer Div. Ohio River, Cincinnati.
T. Gaddie.
IN: Proceedings of REMR Workshop on Assessment of the Stability of Concrete Structures on Rock, September 10-12, 1985. Final Report, January 1987. p 10-13, 1 tab.

Descriptors: *Anchors, *Rock mechanics, *Structural engineering, *Stability analysis, *Design criteria, Dam stability, Locks, Piers, Materials testing, Rock testing, Rock properties, Structural behavior.

Within the last 20 yr, rock anchors have been used to repair fractures and to improve stability of 28 structures within the Ohio River Division. Twenty-two of these applications were for the purpose of assuring stability of both new and existing structures such as miter sills, locks, lockwalls, gated dams, spillways, dam coffers, and dam piers. Stability criteria for the design of rock anchors varied substantially according to the degree to which foundation strengths, geologic conditions and loadings were known or could reasonably be determined. Less conservative factors of safety were used where detailed foundation investigations were conducted (by means of calyx holes, hand-cut foundation block specimens, point and fault mapping, and extensive laboratory testing) and reasonably conservative failure plane assumptions were employed. Previous maximum loadings on existing structures were carefully considered. Where appropriate, consultants were employed to evaluate design parameters, analyses, and procedures. Considerable engineering judgement went into selecting design criteria that were compatible with the degree of certainty to which other design parameters could reasonable be established. Tables of the 22 stability applications are presented and slides of remedial work are discussed. (See also W88-02590) (Geiger-PTT)
W88-02591

SUMMARY OF EXPERIENCES, PROBLEMS, AND NEEDS OF NORTH CENTRAL DIVISION,
Corps of Engineers, Chicago, IL. North Central Div.
H. Singh.
IN: Proceedings of REMR Workshop on Assessment of the Stability of Concrete Structures on Rock, September 10-12, 1985. Final Report, January 1987. p 14-22, 3 fig, 4 tab.

Descriptors: *Stability analysis, *Locks, *Rock testing, *Rock properties, *Structural engineering, Rock mechanics, Concrete testing, Materials testing, Concrete construction.

The North Central Division of the U. S. Army Corps of Engineers evaluated the stability of existing Corps structures on rock foundations in the Great Lakes areas, along the Upper Mississippi River and its drainage areas, and along part of the St. Lawrence Seaway. Results showed that a great majority of the structures do not satisfy the current stability requirements. Results typical of those found in the investigation are presented for three lock structures. Remedial measures in the form of posttensioned anchors are needed to stabilize the structures. An in-depth review of the method of analysis, loads considered, and the shear strength parameters used in the evaluations revealed that our methods of computing earth pressures, and the shear strength selection procedure for rock foundations are very conservative. Methods for estimating at-rest pressure against structures need to be developed for compacted backfill with reasonable accuracy to be used in the evaluation of the structures on hard rock. Shear strength parameters of discontinuities should be used in design rather than the shear strength of intact rock and the sliding friction angles of precut rocks. Guidelines are needed on the selection procedures for shear strength parameters and selecting test specimens for discontinuities. The magnitude of resistive forces such as shear stresses should be evaluated and incorporated into existing methods of overturning stability analysis. (See also W88-02590) (Geiger-PTT)
W88-02592

SURVEY OF STABILITY INVESTIGATIONS OF CONCRETE STRUCTURES ON ROCK,
Army Engineer District, Omaha, NE.
For primary bibliographic entry see Field 8F.
W88-02593

STABILITY ANALYSIS OF TROY LOCK AND DAM,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Structures Lab.
For primary bibliographic entry see Field 8A.
W88-02594

REVIEW OF METHODS OF ANALYZING THE STABILTY OF CONCRETE STRUCTURES ON ROCK FOUNDATIONS,
C. Groves.
IN: Proceedings of REMR Workshop on Assessment of the Stability of Concrete Structures on Rock, September 10-12, 1985. Final Report, January 1987. p 36-40.

Descriptors: *Dam stability, *Concrete dams, *Stability analysis, Concrete testing, *Rock Testing, Concrete technology, Rock mechanics, Structural engineering, Dam foundations, Locks, Monitoring, Anchors.

In the stability evaluation of Troy Lock and Dam, it was concluded that the critical failure mode for sliding is through a hypothetical stress relief joint which is assumed to run completely across the structure a short distance into the foundation. Repair of the monoliths and lock walls would involve evaluations for acceptable stability criteria, safety factors for sliding, overturning analysis, and filling foundation voids. Safety factors are computed for cases of normal operation, dewatered cases, normal operation with pseudo-static earthquake cases, and dewatered cases with a pseudo-static earthquake. Sealing of the monolith construction joints could result in the blocking of natural drainage paths, resulting in higher hydrostatic pressures behind the landside lock monolith. If these repairs are made, it is recommended that one-way drains be installed through the lock monolith to drain the water level in the granular backfill. Measures should be taken to control blasting to minimize accelerations of the structure and backfill which could result in increased soil pressures. Additional instrumentation should be installed and monitored prior to and during the blasting to measure wall movements and rotation during the blasting operations. (See also W88-02590) (Geiger-PTT)
W88-02595

TVA ASSESSMENT OF STABILITY OF CONCRETE STRUCTURES ON ROCK,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 8A.
W88-02596

BUREAU OF RECLAMATION CURRENT PRACTICES OF CONCRETE STRUCTURES ON ROCK FOUNDATIONS,
Bureau of Reclamation, Washington, DC.
For primary bibliographic entry see Field 8A.
W88-02597

FEDERAL ENERGY REGULATORY COMMISSION DAM SAFETY PROGRAM,
Federal Energy Regulatory Commission, Washington, DC.
For primary bibliographic entry see Field 8A.
W88-02598

COMPUTER CODES AVAILABLE TO ASSIST IN STABILITY ANALYSIS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 8A.
W88-02599

DETECTION AND MONITORING OF STRUCTURAL DEFICIENCIES IN THE ROCK FOUNDATION OF LARGE DAMS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 8A.
W88-02600

COMMENTS ON A PROPOSED INVESTIGTION OF LATERAL EARTH PRESSURES EXERTED BY BACKFILLS,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
For primary bibliographic entry see Field 8A.
W88-02601

LIMITS FOR PRESSURE TUNNELS WITHOUT STEEL LININGS,
Technische Univ. Muenchen (Germany, F.R.). Inst. for Hydraulic Engineering.
H. Blind, and J. Schwarz.
International Water Power and Dam Construction IWPCDM, Vol. 39, No. 7, p 51-54, July 1987. 7 fig, 4 ref.

Descriptors: *Pressure tunnels, *Design criteria, *Water resources development, *Dams, *Hydroelectric power, *Rock mechanics, Load, Pressure.

The necessity of a steel lining for pressure tunnels and shafts is an important factor for the costs of hydropower plants. In the early stages of a project design, the basic decision must be taken on whether a steel lining is required, and if so, how long it should be. But at this time only a little information is available, such as topography, an initial rock classification and the internal pressure. A static calculation can give an indication, with a wide scattering of data; schematic criteria for the rock cover are only part of the information. In this article, experiences at existing plants are evaluated. Based on a collection of data from more than 200 pressure tunnels and shafts, with about 400 sections, the relationships between rock cover, rock quality and load are shown. (Author's abstract)
W88-02702

DROUGHT, RAIN, AND MOVEMENT OF A RECURRENT EARTHFLOW COMPLEX IN NEW ZEALAND,
Ministry of Works and Development, Christchurch (New Zealand).
M. J. McSaveney, and G. A. Griffiths.
Geology GLGYB, Vol. 15, No. 7, p 643-646, July 1987. 3 fig, 1 tab, 9 ref.

Descriptors: *Model studies, *Rock mechanics, *Landslides, *Rainfall, *Mass wasting, *Mudflows, *Drought effects, Leaching, Weathering, Geology, Prediction.

In 1978, a 20,000,000 cu m landslide of about 900-yr return period was reactivated near Waipara River, South Island, New Zealand, in lower Tertiary marine muds, marls, sands, and limestone. A central block moved 155 m, reaching about 5 micron/s after 3 months, before slowing exponentially over 4 yr. Movement began after a wet winter of 100-yr return period, but a previous drought may have hastened the movement. The sequence of dry summer and wet winter had a 1 in 1500-yr recurrence interval. A favored hypothesis for the role of drought is desiccation cracking, allowing greater or more thorough wetting of impermeable regolith. Acid leaching of calcite as pyrite weathered and dilation of overcompacted

mudstone also occurred. Movement began as the water store peaked at the end of winter and rising shear stress exceeded diminishing strength. A kinematic model showing viscosity, friction, and linearly varying thrust explains most of the movement. Small spurts in movement, perhaps from growth of the head region, suggest that ultimate displacement was unpredictable. The net driving force was so very small relative to gravity's downslope pull that a deterministic model including slope and gravity would require impossible precision to give useful predictions. If the preconditioning role of drought is not refuted, the antithesis of current palliatives (spray irrigation to prevent desiccation) may be needed to reduce the likelihood of recurrence. (Author's abstract)
W88-02838

STATE-OF-THE-ART FOR ASSESSING EARTHQUAKE HAZARDS IN THE UNITED STATES, REPORT 19: THE EVIDENCE FOR RESERVOIR-INDUCED MACROEARTHQUAKES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Geotechnical Lab.
R. B. Meade.
Available from the National Technical Information Service, Springfield, VA 22161, as ADA-116449, A09 in paper copy, A01 in microfiche. Miscellaneous paper S-73-1, June 1982. Report 19 of a Series. 192 p, 82 fig, 20 tab, 79 ref. Project No. CWIS 31039.

Descriptors: *Earthquakes, *Reservoirs, *Stability analysis, *Seismology, Reservoir operation, Reservoir construction, Statistical analysis, Seismic properties, Seismic waves, Correlation analysis.

The published evidence of reservoir-induced macroearthquakes is critically reviewed. Three types of evidence are examined to recognize the effects of common methods of data acquisition and treatment. They include: evidence of a postimpoundment increase in seismicity; correlation evidence that is composed of a plot of a reservoir variable and a seismicity variable and, in most cases, an auxiliary variable, time; and evidence based on the slope of the magnitude-frequency relationship. Postimpoundment changes in seismicity can be evaluated by certain statistical tests. The interpretation of correlation evidence is subjective because the assumptions required to construct and interpret the evidence cannot be verified. Eight cases of reservoir induced macroearthquakes are reviewed. Three of these cases appear to be well documented cases of induced seismicity. To cases do not appear to be due to reservoir - induced seismicity, but to natural local seismicity. The remaining three cases present insufficient evidence to support a conclusion. (Geiger-PTT)
W88-02921

MAP SHOWING OUTCROPS OF PRE-QUATERNARY ASH-FLOW TUFFS AND VOLCANICLASTIC ROCKS, BASIN AND RANGE PROVINCE, NORTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-02971

MAP SHOWING OUTCROPS OF THICK, DOMINANTLY ARGILLACEOUS SEDIMENTARY AND METASEDIMENTARY ROCKS, BASIN AND RANGE PROVINCE, SOUTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
W. D. Johnson.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4116-E, 1984. 20 p, 2 fig, 1 tab, 30 ref, map.

Descriptors: *Argillaceous rocks, *Maps, *Basin and Range province, *California, Geology, Hydrogeology.

The distribution of geologic formations containing dominantly argillaceous sedimentary and metasedimentary units generally in excess of 500 feet thick are shown within the Basin and Range province of southern California as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The lithologic character, thickness, and sources of data on the thick dominantly argillaceous units, which range in age from Late Precambrian to early Permian, are described. (USGS)
W88-02987

MAP SHOWING OUTCROPS OF PRE-QUATERNARY ASH-FLOW TUFFS AND VOLCANICLASTIC ROCKS, BASIN AND RANGE, PROVINCE, UTAH,
Geological Survey, Lakewood, CO. Water Resources Div.
K. Roggensack, and J. E. Jenness.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4122-F, 1984. 42 p, 2 fig, 93 ref, map.

Descriptors: *Ash-flow tuffs, *Volcaniclastic rocks, *Utah, *Maps, Basin and Range province.

Outcrops of ash-flow tuffs and volcaniclastic rocks have been delineated in Utah as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The lithologic character, thickness, geologic age, distribution, and sources of data of the ash-flow tuffs and volcaniclastic rocks are described. (USGS)
W88-02988

MAP SHOWING OUTCROPS OF GRANITIC ROCKS AND SILICIC SHALLOW-INTRUSIVE ROCKS, BASIN AND RANGE PROVINCE, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
F. A. Hills, and K. A. Sargent.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4118-D, 1984. 60 p, 2 fig, 1 tab, 134 ref.

Descriptors: *Granitic rocks, *Maps, *Basin and Range province, *New Mexico, Intrusive rock, Geology, Hydrogeology.

Outcrops of granitic rocks and silicic shallow-intrusive rocks in the Basin and Range province of New Mexico are described as part of a study of the Basin and Range province of the western United States by the U.S. Geological Survey. The lithologic characteristics, geologic age, distribution, and the sources of data for the rocks are tabulated. (USGS)
W88-02989

MAP SHOWING OUTCROPS OF TERTIARY BASALTIC ROCKS, BASIN AND RANGE PROVINCE, NORTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
F. A. Hills, T. L. T. Grose, and D. A. Lopez.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4115-E, 16 p, 2 fig, 15 ref, map.

Descriptors: *Basaltic rocks, *Maps, *Basin and Range province, *California, Geology, Hydrogeology.

Outcrops of basaltic rocks have been delineated in northern California as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The lithologic character, thickness, geologic age, distribution, and sources of data of the basaltic rocks are described. (USGS)
W88-02990

MAP SHOWING OUTCROPS OF BASALTIC ROCKS OF EARLY QUATERNARY AND TERTIARY AGE, BASIN AND RANGE PROVINCE, SOUTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
K. Roggensack, and D. A. Lopez.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4116-G, 1984. 30 p, 2 fig, 96 ref, 1 map.

Descriptors: *Basaltic rocks, *California, *Maps, Geology, Hydrogeology, Basin and Range province.

Outcrops of basaltic rocks have been delineated in southern California as part of a study by the U.S. Geologic Survey of the Basin and Range province of the western United States. The lithologic character, thickness, geologic age, distribution, and sources of data of the basaltic rocks are described. (USGS)
W88-02991

MAP SHOWING OUTCROPS AND LITHOLOGY OF INTRUSIVE ROCKS, BASIN AND RANGE PROVINCE AND VICINITY, TRANS-PECOS TEXAS,
Geological Survey, Lakewood, CO. Water Resources Div.
C. D. Henry, and G. L. Fisher.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4121-D, 1984. 42 p, 3 fig, 49 ref.

Descriptors: *Intrusive rocks, *Maps, *Basin and Range province and vicinity, *Texas, Geology, Hydrogeology.

Outcrops of intrusive rocks have been delineated in Trans-Pecos Texas as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The lithologic character, geologic age, distribution, and sources of data of the intrusive rocks are described. (USGS)
W88-02992

MAP SHOWING OUTCROPS OF BASALTIC ROCKS, BASIN AND RANGE PROVINCE AND VICINITY, TRANS-PECOS TEXAS,
Geological Survey, Lakewood, CO. Water Resources Div.
C. D. Henry, and G. L. Fisher.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4121-F, 1984. 10 p, 5 fig, 24 ref.

Descriptors: *Basaltic rocks, *Maps, *Basin and Range province, *Texas, Geology, Hydrogeology.

Outcrops of basaltic rocks have been delineated in Trans-Pecos Texas as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States to evaluate potentially suitable areas for future study for isolation of high-level radioactive waste. In this map report, the geologic name, location, isotopic age, lithologic character, and reference sources for each basaltic unit are described. (USGS)
W88-02993

MAP SHOWING OUTCROPS OF THICK, DOMINANTLY ARGILLACEOUS SEDIMENTARY ROCKS, BASIN AND RANGE PROVINCE, NEW MEXICO,
Geological Survey, Lakewood, CO. Water Resources Div.
W. D. Johnson.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4118-E.

Descriptors: *Argillaceous rocks, *Maps, *Basin and Range province, *New Mexico, Geology, Hydrogeology.

Outcrops of argillaceous rocks generally thicker than 500 feet have been delineated in the Basin and Range province of New Mexico as part of a study by the U.S. Geological Survey within the Basin and Range province of the western United States. The distribution, lithologic character, geologic

age, thickness, and sources of data of the argillaceous units, which range in age from Late Pennsylvanian to early Tertiary, are described. (USGS)
W88-02994

MAP SHOWING OUTCROPS OF PRE-QUATERNARY ASH-FLOW TUFFS, BASIN AND RANGE PROVINCE, SOUTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
J. E. Jenness, and D. A. Lopez.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4116-F.

Descriptors: *Ash-flow tuffs, *Maps, *Basin and Range province, *California, Geology, Hydrogeology.

Outcrops of ash-flow tuffs have been delineated in southern California as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The lithologic character, thickness, geologic age, distribution, and sources of data of the ash-flow are described. (USGS)
W88-02995

MAP SHOWING OUTCROPS OF GRANITIC ROCKS AND SILICIC SHALLOW-INTRUSIVE ROCKS, BASIN AND RANGE PROVINCE, NORTHERN CALIFORNIA,
Geological Survey, Lakewood, CO. Water Resources Div.
F. A. Hills, D. A. Lopez, and T. L. T. Grose.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4115-C, 1984. 10 p, 2 fig, 11 ref, map.

Descriptors: *Granitic rocks, *Intrusive rocks, *Maps, *Basin and Range province, *California, Geology, Hydrogeology.

Outcrops of granite rocks and silicic, shallow-intrusive rocks in the Basin and Range province of northern California have been compiled and described as part of a study of the Basin and Range province of the western United States by the U.S. Geological Survey. The lithologic characteristics, geologic age, distribution, and sources of data for the geologic units are tabulated. (USGS)
W88-02996

MAP SHOWING OUTCROPS OF THICK, DOMINANTLY ARGILLACEOUS SEDIMENTARY AND METASEDIMENTARY ROCKS, BASIN AND RANGE PROVINCE, IDAHO,
Geological Survey, Lakewood, CO. Water Resources Div.
W. D. Johnson.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigations Report 83-4117-D, 1984. 20 p, 2 fig, 26 ref, 1 map.

Descriptors: *Argillaceous rocks, *Maps, *Basin and Range province, *Idaho, Geology, Hydrogeology.

Outcrops of thick argillaceous sedimentary rocks generally in excess of 500 feet thick have been delineated within the Basin and Range province in Idaho as part of a study by the U.S. Geological Survey of the Basin and Range province of the western United States. The age, lithologic character, thickness, distribution, and sources of data of thick argillaceous geologic units are described. (USGS)
W88-02997

DATA FOR FOUR GEOLOGIC TEST HOLES IN THE SACRAMENTO VALLEY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 7B.
W88-03096

GEOLOGIC FRAMEWORK OF THE GROUNDWATER FLOW SYSTEM IN JURASSIC AND CRETACEOUS ROCKS, NORTHERN GREAT PLAINS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03109

IDENTIFICATION AND TABULATION OF GEOLOGICAL CONTACTS IN THE EDWARDS AQUIFER, SAN ANTONIO AREA, TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W88-03385

LINEAR FEATURES DETERMINED FROM LANDSAT IMAGERY IN THE TEXAS AND OKLAHOMA PANHANDLES,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03417

LINEAR FEATURES DETERMINED FROM LANDSAT IMAGERY IN WESTERN KANSAS,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W88-03418

8F. Concrete

PROCEEDINGS OF REMR WORKSHOP ON ASSESSMENT OF THE STABILTY OF CONCRETE STRUCTURES ON ROCK.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Structures Lab.
For primary bibliographic entry see Field 8E.
W88-02590

SURVEY OF STABILITY INVESTIGATIONS OF CONCRETE STRUCTURES ON ROCK,
Army Engineer District, Omaha, NE.
L. Schlaht.
IN: Proceedings of REMR Workshop on Assessment of the Stability of Concrete Structures on Rock, September 10-12, 1985. Final Report, January 1987. p 23-26.

Descriptors: *Concrete testing, *Concrete technology, *Rock testing, *Concrete construction, *Stability analysis, Design criteria, Rock properties, Rock mechanics, Materials testing, Surveys, Structural engineering, Strength.

Omaha District personnel conducted a survey in early 1985 pertaining to methods and criteria used on completed and ongoing stability investigations for Corps of Engineers concrete structures on rock foundations. During the course of the survey, it was noted that there was some confusion and dissatisfaction involving methods and applicable criteria for the stability of concrete structures on rock foundations. The confusion was attributed in part to the numerous references within the Corps of Engineers on stability criteria, depending on the type of structure, and also to changes made in the criteria. To improve the overall system of stability investigations procedures and criteria, it was recommended that all structural stabilty procedures and criteria be combined into one reference document, additional research using instrumentation data be used to determine the possibility of using less severe uplift assumptions for reevaluation analyses, and the criteria for the required factor of safety be changed to allow more flexibilty for variations in shear strengths and loading conditions. More discussions on the selection of shear strengths are needed in any document where criteria are revised. The presentation and listing of computer programs which are acceptable for analysis of structures in revised stability criteria documents should be considered. Additional research should be performed on data available from other owners of structures, such as the Bureau of Reclamation, to determine whether similar problems of inadequacy under reevaluation processes have been confronted. (See also W88-02590) (Geiger-PTT)
W88-02593

STABILITY ANALYSIS OF TROY LOCK AND DAM,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Structures Lab.
For primary bibliographic entry see Field 8A.
W88-02594

REVIEW OF METHODS OF ANALYZING THE STABILTY OF CONCRETE STRUCTURES ON ROCK FOUNDATIONS,
For primary bibliographic entry see Field 8E.
W88-02595

TVA ASSESSMENT OF STABILITY OF CONCRETE STRUCTURES ON ROCK,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 8A.
W88-02596

BUREAU OF RECLAMATION CURRENT PRACTICES OF CONCRETE STRUCTURES ON ROCK FOUNDATIONS,
Bureau of Reclamation, Washington, DC.
For primary bibliographic entry see Field 8A.
W88-02597

FEDERAL ENERGY REGULATORY COMMISSION DAM SAFETY PROGRAM,
Federal Energy Regulatory Commission, Washington, DC.
For primary bibliographic entry see Field 8A.
W88-02598

COMPUTER CODES AVAILABLE TO ASSIST IN STABILITY ANALYSIS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 8A.
W88-02599

DETECTION AND MONITORING OF STRUCTURAL DEFICIENCIES IN THE ROCK FOUNDATION OF LARGE DAMS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 8A.
W88-02600

8G. Materials

RECENT EXPERIMENTAL STUDIES DEALING WITH CORROSION AND DEGRADATION OF MATERIALS IN OZONE-CONTAINING ENVIRONMENTS,
Union Carbide Corp., Tonawanda, NY. Linde Div.
R. Zawierucha, and H. Charleson.
IN: Handbook of Ozone Technology and Applications. Volume 1. Ann Arbor Science, Ann Arbor, MI. 1982. p 227-252, 5 fig, 6 tab.

Descriptors: *Materials testing, *Corrosion, *Ozone, *Water treatment, *Ozonation, Nickel, Copper, Pitting, Steel, Performance evaluation.

Materials were tested for structural compatibility in high-humidity ozone-bearing gaseous environments and in liquid phases with high levels of dissolved oxygen and ozone. With the exception of copper and nickel-copper alloys, which performed poorly, the performance of metallic materials in the ozone test program was very similar to what has been experienced in an oxygen activated sludge system and air activated sludge systems. This finding tends to increase confidence in the safety of high-purity oxygen-based ozone systems. Severe pitting and crevice corrosion may occur in wet ozone applications. Perforation may occur

even when accompanied by low general corrosion rates. From the standpoint of pitting and crevice corrosion, 444L stainless steel (18Cr-2Mo) is a superior performer. While individual alloys exhibited markedly better performance in either the vapor phase or liquid phase, neither environment is generally more severe than the other. Caution must be exercised in the specification and use of nonmetallic materials due to compositional variations within generic groupings. Consequently, significant performance differences in ozone service may occur. Further experimental work with nonmetallic materials in ozone service may be warranted, depending on specific requirements. (See also W88-02503) (Lantz-PTT)
W88-02507

SUMMARY REPORT ON PVC CONTRACTION JOINT-FORMING WATERSTOPS,
Water and Power Resources Service, Denver, CO. Engineering and Research Center.
H. Johns.
REC-ERC-84-15, January 1984. 14 p, 10 fig, 3 tab.

Descriptors: *Materials testing, *Water stops, *Construction joints, *Sealants, Canal linings, Linings, Plastics, Bostik Mastic Tester, Polyvinyl chloride, Concrete, Pleasant Valley Canal, Central Valley Project, San Luis Canal, Tehema-Colusa Canal, California.

Cycling fatigue tests and constant-load elongation tests were conducted on eight contraction joint-forming waterstop. Conclusions are: (1) fatigue cycling of the polyvinyl chloride (PVC) strips in the Bostik Mastic Tester does not distress the waterstop section or cause deformation of the waterstop sealing bulbs; (2) constant load elongation tests show that if the PVC strip is free to deform, it may stretch to failure, but field experience is that only in unusual circumstances do canal concentration joints open more than 3.2 mm; (3) even with large (10.2 mm) and long-term (340 days) elongation of the waterstop section, deformation of the waterstop sealing bulbs will not occur in a properly designed strip; (4) the PVC strips behave almost identically whether strains caused by elongation occur in only a few minutes or develop during long-term loading; and (5) the Bostik Mastic Tester can be a useful tool in a joint sealer research program. (Author's abstract)
W88-02936

SURFACE DYNAMICS MOVIE USING A LASER DOPPLER APPROACH,
Water and Power Resources Service, Denver, CO. Engineering and Research Center.
R. A. Bruce.
Report No. GR-81-4, May 1981. 17 p, 5 fig, 5 ref, append.

Descriptors: *Materials engineering, *Metals, *Deformation, *Vibrations, Lasers, Graphic analysis, Computer programs, Doppler approach, Dynamics, Motion pictures.

A movie of the dynamics of an impulsed metal plate was produced by computer from velocity measurements taken with a laser Doppler sensor. Measurements of 205 separate points were made in precise synchronization to a repeatable impulse. These were recorded individually, integrated to give deformation, and stored sequentially on a computer file. The computer sorted the deformation data into files representing the plate surface as a function of time. A movie was then produced of the plate motion by plotting successive three-dimensional computer graphics of the plate on a frame-by-frame basis. The movie displays deformation exaggerated 2000 times with a time expansion also of 2000 times. The laser Doppler approach for the thin plate test is a very appropriate choice. Mass loading by a conventional accelerometer is effectively demonstrated by movie segments with and without the device attached. Motion (velocity) at the site with the accelerator is an order of magnitude smaller than without. Neighboring sites 20 mm away are down by 50 percent. The laser Doppler approach has the important advantage of not affecting the measurement on small or thin test objects. (Author's abstract)
W88-02949

USE OF GEOMEMBRANES IN ITALIAN DAMS,
Centro di Ricerca Idraulica e Strutturale, Milan (Italy).
D. Cazzuffi.
Water Power and Dam Construction, Vol. 39, No. 3, p 17-21, March 1987. 5 fig, 3 tab, 14 ref.

Descriptors: *Geomembranes, *Italy, *Dam design, *Seepage control, *Dam construction, *Materials engineering, *Waterproofing, Dams, Engineering, Hydraulic engineering, Hydraulic structures, Civil engineering, Reservoirs, Case studies, Cofferdams, Embankments, Concrete dams, Dam rehabilitation.

The use of geomembranes in Italian dams is reviewed, particularly with regard to the upstream facing of embankment dams and cofferdams, the waterproofing of permeable zones in the reservoir area, and the rehabilitation of old concrete dams. Most of the dams described are owned by the state power authority, ENEL. Among the dams described are the Contrada Sabetta rockfill dam, using a geomembrane as the waterproofing element of the upstream facing; the Castreccioni dam, using a geomembrane to prevent leakage in a very permeable part of the reservoir area close to the concrete dam; and three old concrete dams where geomembranes were installed for maintenance purposes. As far as the use of geomembranes is embankment dams is concerned, there have already been some positive results in terms of the good behavior of the water proofing systems and also the progressive evolution of techniques. (Doria-PTT)
W88-03200

TRIPLE USE OF A GEOTEXTILE AT AIT CHOUARIT,
Dumez S.A., Nanterre (France).
A. Biche.
Water Power and Dam Construction, Vol. 39, No. 3, p 22-23, March 1987. 3 fig.

Descriptors: *Geotextiles, *Morocco, *Dam design, *Dam construction, *Ait Chouarit Dam, *Materials engineering, Cost-benefit analysis, Dams, Hydraulic structures, Engineering, Hydraulic engineering, Drinking water, Cofferdams, Drainage systems, Case studies, Drains, Rockfill dams, Filters.

The use of a geotextile at the Ait Chouarit dam is described. This dam is part of a complex development of the Haouz plain which surrounds the town of Marrakech, Morocco. The 144 m-high rockfill dam has a thin, vertical clay core. Topics discussed include the placement of the fill, core, and geotextile, the downstream drainage system, and the dam crest. The geotextile used was Bidim U64, a needle-punched, nonwoven geotextile made from continuous 100% polyester filaments. It is concluded that geotextile placement is easy, and their cost should generally be lower than that of the traditional materials they replace. (Doria-PTT)
W88-03201

DEVELOPMENTS IN GEOCOMPOSITE RESEARCH IN THE GDR,
VEB Spezialbaukombinat Wasserbau, Weimer (German D.R.)
D. Martin, and F. Sanger.
Water Power and Dam Construction, Vol. 39, No. 3, p 24-26, March 1987. 3 fig, 6 ref.

Descriptors: *East Germany, *Geotextiles, *Geomembranes, *Hydraulic engineering, *Membrane engineering, *Geocomposites, Engineering, Civil engineering, Hydraulic structures, Technology, Hydraulic valves.

The use of composite geotextiles and geomembranes in civil and hydraulic engineering in the German Democratic Republic is reviewed. The development of the methodology and materials are discussed. At present, research is being conducted on effective recycling methods for geocomposite manufacture. New technical solutions for geotechnical design in earthworks and hydraulic engineering include valve membranes to protect against uplift and a vertical impervious geomembrane/geotextile composite core. (Doria-PTT)
W88-03202

RECENT APPLICATIONS OF GEOTEXTILE FILTERS IN CHINA,
Nanjing Hydrological Research Inst. (China).
T. Tong-Kang, Z. Zhao-Chang, and T. Ren-Nan.
Water Power and Dam Construction, Vol. 39, No. 3, p 35-39, March 1987. 9 fig, 6 ref.

Descriptors: *China, *Geotextiles, *Filters, *Material engineering, *Case studies, *Performance evaluation, Dams, Earth dams, Polders, Dikes, Embankments, Dam design, Earthworks, Filtration, Seepage control, Dam failure, Seepage, Waves, Fluid mechanics.

Two case studies are described to examine the effectiveness of geotextiles as filters at an earth dam and a polder dike in China. The earthfill dam of the Maizihe Reservoir in Yunnan province was subjected to seepage calculations, filtration tests, strength analysis, bursting analysis, and puncturing analysis. The Shanghai ash dam was subjected to seepage calculations and filtration tests. When a needlepunched, nonwoven geotextile was used for the earth dam, the filtration properties were similar to those of a granular filter; when a woven geotextile was applied to the polder dike, with the specific grain-size distribution, the soil stratum itself gradually became a natural filter so that the anti-seepage capacity of the foundation soil was improved. It is concluded that laboratory tests taking account of actual site conditions are necessary to determine the physical, mechanical, and hydraulic properties of the fabrics to be used; these tests, along with in situ observations, are essential to control permeability and to assess the strength and rate of aging of geotextiles. (Doria's-PTT)
W88-03203

8I. Fisheries Engineering

CREATION OF FISHERY HABITAT IN ESTUARIES,
National Marine Fisheries Service, Galveston, TX. Galveston Lab.
For primary bibliographic entry see Field 2L.
W88-02567

OVERVIEW OF THE BENEFICIAL USES OF DREDGED MATERIAL,
Army Engineer Inst. for Water Resources, Fort Belvoir, VA.
For primary bibliographic entry see Field 2L.
W88-02568

HABITAT DEVELOPMENT APPLICATIONS: LOWER POOL 5 CHANNEL MAINTENANCE/WEAVER BOTTOMS REHABILITATION PLAN,
Fish and Wildlife Service, Winona, MN.
For primary bibliographic entry see Field 5E.
W88-02569

HABITAT DEVELOPMENT APPLICATIONS: BENEFICIAL USES OF DREDGED MATERIAL ON THE LOWER SNAKE RIVER--PRESENT AND POTENTIAL APPLICATIONS AND CONSTRAINTS,
Corps of Engineers, Walla Walla, WA. Walla Walla District.
For primary bibliographic entry see Field 5E.
W88-02574

SPECIAL APPLICATIONS AND CONCEPTS: USE OF DREDGED MATERIAL CONTAINMENT AREAS FOR AQUACULTURE,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 5E.
W88-02579

SPECIAL APPLICATIONS AND CONCEPTS: BENEFITS OF UNDERWATER BERMS,
Corps of Engineers, Mobile, AL. Mobile District.
For primary bibliographic entry see Field 5E.
W88-02583

NATURAL PROPAGATION AND HABITAT IMPROVEMENT - WASHINGTON, VOLUME IIB, SIMILKAMEEN RIVER HABITAT INVENTORY.
Bonneville Power Administration, Portland, OR. Div. of Fish and Wildlife.
Available from the National Technical Information Service, Springfield, Virginia. 22161, as DE84-015939. Price codes: A08 in paper copy, A01 in microfiche. DOE Report No. DOE/BP--247-Vol.2B, April 1984. 73 p, 18 fig, 25 tab, 51 ref. Fish and Wildlife Program Contract No. DE-AC79-83BP11902, and Project No. 83-477.

Descriptors: *Fish barriers, *Stream fisheries, *Rivers, *Fish management, *Fish passages, *Fish populations, Aquatic habitats, Trout, Sucker, Whitefish, Sculpin, Salmon, Smolt, Dam effects, Spawning, Surveys, Waterfalls.

During the summer low flow period, a habitat assessment of the Similkameen, Tulameen, Ashnola and Pasayten rivers in British Columbia and Washington State was conducted between August 10 and October 10, 1983. The biophysical survey assessed 400 km (250 miles) of stream at 77 stations. Fish sampling was conducted at each station to assess the resident fish populations and standing crop. Rainbow trout populations and standing crops were found to be very low. Large populations of mountain whitefish and bridgelip suckers were present in the mainstem Similkameen River below Similkameen Falls. High densities of sculpins and longnose dace were found throughout the system except for sculpins above the falls, where none were captured. Approximately 961,000 sq m (1,150,000 sq yards) of spawnable area for steelhead trout were estimated for the entire system which could accommodate 98,000 spawners. Nearly 367,000 sq m (439,000 sq yards) of chinook salmon spawnable area was also estimated, capable of accommodating 55,000 chinook. Rearing area for steelhead trout smolts was estimated for the whole system at 1.8 million sq m (2.2 million sq yards). Chinook salmon smolt rearing area was estimated at 700,000 sq m (837,000 sq yards). Rearing area was found to be a limiting factor to anadromous production in the Similkameen River system. Smolt production from the system was estimated at about 610,000 steelhead trout and between 1.6 million and 4.8 million chinook salmon. No water quality, temperature or flow problems for anadromous salmonids were evident from the available data and the habitat inventory. In addition to an impassable falls on the Tulameen River at river mile 32.5, only two other areas of difficult passage exist in the system, Similkameen Falls (a series of chutes) and the steep, narrow lower section of the Ashnola River. (See also W88-02563) (Author's abstract)
W88-02584

FEASABILITY OF USING DISUSED WATER TREATMENT FILTER BEDS FOR REARING CARP (CYPRINIUS CARPIO L.) IN THE U.K.,
Royal Holloway Coll , Egham (England).
K. T. O'Grady, and P. B. Spillet.
Water Research WATRAG, Vol. 21, No. 5, p 549-557, 1987. 4 fig, 3 tab, 26 ref.

Descriptors: *Carp, *Fish stocking, *Water treatment facilities, *Aquaculture, *Filter beds, Resources management, Cost-benefit analysis, Economic aspects.

The feasability of rearing carp (Cyprinus carpio) at a disused water treatment works in East London (U.K.) was investigated. The 10 ha of filter beds represented an atypical site for carp culture; in order to assess whether in-house aquaculture would enable a Water Authority to gain advantage in cost, availability and disease-free status of stock, a series of trials was undertaken. These enabled comparison of the weight of carp produced in relation to: extensive cultivation, artificial feeding, a range of stock densities and a range of ages and sizes. The filter beds were unsuitable for natural spawning, early fry production and the rearing of first-year fish. However, subsequent stages gave good survival (60-80%) and growth rates. Fish stocked at 20 g in April/May reached 200-400 g by September and 1 kg plus, 1 yr later. Production levels of 300-350 kg/ha/yr without artificial foods and up to 2.2 tons/ha/yr with supplementary feeding were comparable with mainland European fish farms. These high values reflect the eutrophic nature of the site and successful exploitation of the available secondary production. It was possible to harvest 15,000-20,000 carp/yr for restocking. Carp rearing integrated with existing operations and activities represents a novel, alternative use of a semi-redundant site. Cost benefit assessment showed that fish production was economically viable returning nominal profit margins of between 1.10 and 2.06 pounds/kg of carp harvested. The resultant cost/benefit ratios per kg harvested were 1:1.9 for extensive production without feeding and 1:1.34-1.43 when intensive cultivation employing artificial foods was used. (Author's abstract)
W88-02825

FISHERY SURVEY AND RELATED LIMNOLOGICAL CONDITIONS OF WILLIAMS LAKE, HUBBARD COUNTY, MINNESOTA,
Geological Survey, Lakewood, CO. Water Resources Div.
W. W. Taylor, J. W. LaBaugh, M. H. Freeburg, and D. C. Dowling.
Available from USGS, OFFSS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 84-4145, 1985. 25 p, 10 fig, 11 tab, 5 ref.

Descriptors: *Limnology, *Lakes, *Minnesota, Phytoplankton, Zooplankton, Benthos, Aquatic plants, Fish, Hubbard County, Williams Lake.

Bluegill (Lepomis macrochirus), pumpkinseed sunfish (Lepomis gibbosus), largemouth bass (Micropterus salmoides), yellow perch (Perca flavescens) rock bass (Amploplites rupestris), black crappie (Pomozis nigromaculatus), and northern pike (Esox lucius) were found in Williams Lake, Hubbard County, Minnesota, during a fishery survey of the lake in late August 1982. The most abundant fish were the bluegills. These fish live in the large littoral zone of the lake; this zone underlies 55% of the surface area of the lake. The most ubiquitous benthic invertebrate in the littoral zone (amphipods) and the most abundant benthic invertebrate (chironomid larvae) were major food sources for the bluegill. Other organisms found in the stomach contents of fish collected in this survey were zooplankton, gastropods, Diptera larvae, odonates, terrestrial insects, and other fish. Daphnia were the only zooplankters of a diverse plankton community that were found in stomach contents. The abundance of fish other than bluegill was typical for a system in which northern pike is the major predator. (USGS)
W88-03063

9. MANPOWER, GRANTS AND FACILITIES

9D. Grants, Contracts, and Research Act Allotments

ANNUAL REPORT: 1982-1983.
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
(1984). 66 p.

Descriptors: *Water treatment, *Wastewater treatment, Wastewater irrigation, Irrigation, Water supply, Storm water, Indicators, Pearl Harbor, Hawaii, Soil-water relationships, Drip irrigation, Solar distillation, Distillation, Viruses, Clostridium perfringens, Pollutant identification, Salinity, Fate of pollutants, Water pricing, Economic aspects, Remote sensing, Water conservation, Bacteria, Coliforms, Monitoring, Rainfall, Filtration.

Research on several subjects was conducted at the Water Resources Research Center, Hawaii. The use of airport runway storm water runoff was not suitable as a source for drinking water. Clostridium perfringens was not a suitable indicator of water quality in streams receiving sewage effluents. The groundwater resources of Pearl Harbor basin are sufficient to support a population increase of 450,000 provided sugarcane and pineapple cultivation are discontinued. Flexible impermeable membrane impoundments proved a feasible way to collect stream water in a coastal embayment. Wastewater reuse in drip irrigation was studied with emphasis on prevention of plugging of the tubes. Up to 91% BOD removal was accomplished in a rotating biological contactor under high salinity conditions. A low-cost solar still and rainfall catchment system was developed from a child's plastic wading pool. Wastewater irrigation studies showed that alfalfa and guineagrass removed 15% and 70%, respectively, of applied nitrogen. A pulsed-bed filtration unit at a primary wastewater treatment plant removed 41% BOD and 38% COD. (Cassar-PTT)
W88-02960

WATER RESOURCES INVESTIGATIONS IN MISSISSIPPI, 1984-85,
Geological Survey, Jackson, MS. Water Resources Div.
A. G. Lamonds, and C. Moss.
USGS Open-File Report 84-444, 1984. 44 p, 1 fig.

Descriptors: *Water Resources Development, *Mississippi, *Data collections, Hydrological data, Water use, Surface water, Groundwater, Sediments, Precipitation, Flood studies.

This report describes the activities of the Water Resources Division in Mississippi. It summarizes progress made in water-resources investigations and related activities in the current fiscal year ending September 30, 1984, and outlines the work to be accomplished during the fiscal year ending September 30, 1985. Its specific purpose is to inform cooperating State, local, and other Federal agencies about all activities of this Division in water investigations in Mississippi and to give those cooperators a better understanding of how their participation fits into the total USGS program of water resources investigations. (USGS)
W88-02998

WATER RESOURCE RESEARCH GRANT PROGRAM PROJECT DESCRIPTIONS, FISCAL YEAR 1986.
Geological Survey, Reston, VA. Water Resources Div.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File-Report 86-548, 1986. 88 p, 4 tab.

Descriptors: *Water research, *Research projects, *Grants, *Water management, Water reuse, Climatology, Irrigation efficiency, Legal aspects, System analysis, Economic aspects.

Information is presented on the 43 projects funded by the United States Geological Survey's Water Resources Grant Program in fiscal year 1986. The report gives the grant number; project title; performing organization; principal investigator(s); dates; and a project description which includes (1) identification of the water related problems and problem-solution approach, (2) contribution to problem solution, (3) objectives, (4) approach, and (5) result users. The 43 projects include 14 in the area of groundwater management, 6 in surface-water management, 2 in systems-operating/planning, 3 in irrigation management, 8 in desalination/reuse, 6 in economic/institutional studies, and 4 in climate variability. The reports contain tables showing (1) funding according to research topic, (2) projects funded to type of submitting organization, (3) proposals received, research topic, and funding levels, and (4) submitting organization. A comparison is given to fiscal year 1985 in each case. (USGS)
W88-03004

FISCAL YEAR 1985 PROGRAM REPORT (ALASKA WATER RESEARCH CENTER).
Alaska Univ., Fairbanks. Inst. of Northern Engineering.
Available from the National Technical Information Service, Springfield, VA 22161, as PB87-162384/AS. Price codes: A03 in paper copy, A01 in microfiche. Water Research Center Report G-1002-01, September 1986. 34 p. Contract No. 14-08-001-G-1002. Project No. USGS G-1002-01.

Descriptors: *Research, *Information transfer, *Water Research Institutes, *Alaska, Deicer, Calcium-magnesium acetate, Water quality, Algae, Bacteria, Dissolved oxygen, Zooplankton, Mine water, Recirculated water, Wastewater, Waste treatment, Placer mining, Settling basins, Plant growth regulators, Productivity, Microplankton, Growth kinetics, Snowmelt, Runoff, Model studies, Snow-soil interaction, Frost, Permafrost, Seasonal variation.

Six small projects were funded by the United States Geological Survey (USGS) federal cooperative water resource program in fiscal year 1985. One project studied snowmelt hydrology. One project tested the environmental impact of a new road deicer (calcium magnesium acetate) on the lentic environment, while another project sought to develop new technology for mitigating the adverse effects of placer mining on aquatic environments in Alaska. Another project is contributing to an understanding of the growth mechanisms that control species composition in aquatic environments that have been perturbed by increased usage or intentional fertilization. Since existing snowmelt models did not incorporate some key high-latitude phenomena, another project modified an existing runoff model to incorporate the physical characteristics of the soils. This was a cooperative project with the Norwegian Hydrotechnical Laboratory in Trondheim. Stable nitrogen isotopes are being used in another project to determine the sources of nitrate in groundwaters of interior Alaska. Another project is evaluating small-scale waste treatment systems in Alaska in an effort to improve their performance. During 1985, the Water Research Center administered about 30 water-related research projects and provided training to approximately 17 graduate students and six undergraduate assistants. Cooperative research and/or exchanges were made with Alaskan agencies, the U.S. Environmental Protection Agency, U.S. Geological Survey and the Norwegian Hydrotechnical Laboratories. The Water Research Center also hosted an international symposium on Cold Regions Hydrology sponsored by the American Water Resources Association. (USGS)
W88-03141

FISCAL YEAR 1985 PROGRAM REPORT (CALIFORNIA WATER RESOURCES CENTER),
California Univ., Davis. Water Resources Center.
J. J. DeVries.
Available from the National Technical Information Service, Springfield, VA 22161, as PB87-162376/AS. Price codes: A03 in paper copy, A01 in microfiche. California Water Resources Center, Fiscal Year 1985 Program Report, Univ. of California, Davis. August, 1986. Contract No. 14-08-0001-G1005. Project No. USGS G1005-01.

Descriptors: *California, *Water Research Institutes, *Education, *Research and Development, *Grants, Irrigation, Furrow irrigation, Modelling, Infiltration, Hydrologic cycle, Evapotranspiration, Precipitation, Primary treatment, Waste treatment, Modified aeration, Bioflocculation, Biosorption, Acid deposition, Snow hydrology, Alpine watersheds, Dendroclimatology, Streamflow, Rainfall, Tree-rings, Prediction.

This report contains a synopsis of the results of research projects sponsored under Grant No. 14-08-0001-G1005, The 1985 Water Research Institute Program (WRIP) for the University of California Water Resources center. It also contains summaries of water problems and issues in California and the Water Resources Center's Program Goals and Priorities, Information Dissemination Activities and Cooperative Arrangements. The California WRIP package is a subset of the Center's overall research program and consists of five projects investigating the following topic areas: Furrow Irrigation Model Development and Evaluation; Snow Hydrology for Alpine Watershed Studies of Acid Deposition in the Sierra Nevada; Tree-Ring Reconstruction of Long-Term Precipitation and Streamflow Records from the central Coast Ranges, California; the Flocculation, Aeration, Clarification, (FAC) Process - A Novel Method for the Partial Treatment of Sewage and Upgrading of Existing Plant Performance; Application of Light Stable Isotope Geochemistry to the Study of Large-Scale Meteoric Water Movement in California. (DeVries-CA Water Resources Cr.)
W88-03142

FISCAL YEAR 1985 PROGRAM REPORT (ILLINOIS WATER RESOURCES CENTER),
Illinois Univ. at Urbana-Champaign. Water Resources Center.
G. E. Stout.
Available from the National Technical Information Service Springfield, VA 22161 as PB87-162335/AS. Price codes: A03 in paper copy, A01 in microfiche. Annual Report No. 21. August 1986. 25 p. Contract No. 14-08-0001-G1015. Project No. USGS G1015-01.

Descriptors: *Water Research Institutes, *Research, *Information transfer, *Training, *Illinois, Agricultural runoff, Conservation tillage, Groundwater pollution, Groundwater management, Stream relocation, Channel improvement, Groundwater contamination, Organic compounds, Nitrates, Denitrification.

The University of Illinois Water Resources Center was established in 1963 to 'encourage and coordinate university wide planning and implementation of interdisciplinary programs for research and graduate education in water resources.' Since designation by the Department of the Interior as the 'institute' for Illinois, the center's activities have become statewide. This report describes research accomplishments and other activities of the center during the fiscal year 1985. Working through the center, researchers studied management practices for controlling pesticide runoff from farmland; management of groundwater quality; aquatic habitats, channel configuration and stability in relocated streams; contaminant plumes in landfills and groundwater, and ways to manage the use of nitrogen fertilizer to reduce the potential of water pollution. (Stout-IL Water Resource Cr.)
W88-03143

FISCAL YEAR 1985 PROGRAM REPORT (KANSAS WATER RESOURCES RESEARCH INSTITUTE),
Kansas Water Resources Research Inst., Manhattan.
F. W. Smith.
Available from the National Technical Information Service, Springfield, VA 22161, as PB87-162350/AS. Price codes: A03 in paper copy, A01 in microfiche. Report G1018-01. June 1986. 23 p. Contract No. 14-08-0001-G-1018. Project No. USGS G1018-01.

Descriptors: *Kansas, *Water Research Institutes, *Education, *Training, *Information transfer, Irrigation, Equus beds, Water quality, Decision making, Management, Trihalomethane, Water conservation, Legal constraints, Nitrogen fertilizer, Unconsolidated sediments.

Kansas statutes direct the State Water Plan to deal with management, conservation, and development issues. Additionally the water plan has been extended to include: Fish, Wildlife, Recreation, and Development. KWRRI Projects adhere closely to needs identified by the Kansas Water Office. FY 1985 KWRRI projects will relate to the Kansas Water Authority as follows: Project G 1018-05, dealing with planning procedures, should facilitate decision making as pertaining to irrigation. Two projects, G 1018-03 dealing with the central Kansas equus beds recharge and G 1018-06 dealing with estimation of water demand in northwestern Kansas should aid in conservation efforts. Water quality is a matter of great concern in Kansas. Three projects G1018-07 dealing with a scheme for predicting water quality, G1018-08 involved with the role played by improperly applied nitrogen fertilizer, and G1018-09 involved with trihalomethane precursors should insure greater safety as pertains to reducing contamination of clean water. Development as manifested in Kansas, implies that the State Water Plan shall include sections corresponding with water planning areas as determined by the water office. Major river basins have been established as the water planning areas for the preparation of the Basin Plan sections. Two KWRRI projects G1018-02 dealing with legal constraints and G1018-04 dealing with unconsolidated sediments and rock units have potential for aiding in the basin regions. (Smith-Kansas St. U.)
W88-03144

FISCAL YEAR 1984 PROGRAM REPORT (CONNECTICUT INSTITUTE OF WATER RESOURCES),
Connecticut Univ., Storrs. Inst. of Water Resources.
C. N. Burke.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-158227/AS. Price codes: A03 in paper copy, A01 in microfiche. Program Report G-896-01. September 1985. 44 p, 15 ref. Contract No. 14-08-0001-G896. Project No. USGS G896-01.

Descriptors: *Research, *Connecticut, *Information transfer, Gasoline, Oil spills, Metal finishing wastes, Heavy metals, Groundwater pollution, Leachates, Phosphorous removal, Lake restoration, Eutrophication, Lake management, Groundwater protection.

Alleviation and identification of threats to groundwater supplies was addressed by the following projects: 02, A study of the mechanisms controlling gasoline partitioning and transport in groundwater (G. Hoag, Civil Engineering, Univ. Conn.); 03, Chemical and physical studies of adsorption and reactions of hazardous waste metals and chlorinated hydrocarbons (W. Pringle, Chemistry Dept., Wesleyan Univ.); 04, Contribution of toxic chemicals to groundwater from domestic on-site sewage disposal systems (J. Kolega, Ag. Engineering, Univ. Conn.). Because of urbanization stress on lakes important to state citizens as well as to tourism, the following projects were funded: 05, Diagnosis of watershed and internal phosphorous loading in Candlewood Lake (P. Silver, Biology Dept., Western Conn. State Univ.), and 22, Mirrors of the Landscape: A guide to diagnosing and managing lake ecosystems (P. Rich, Ecology, Univ. Conn.). Technology transfer was accomplished through state conference, 23, Groundwater contamination in Connecticut - a statewide conference (B. Wulff, Biology Dept., Eastern Conn. State Univ.). (Burke-Ct U., Water Resources Inst.)
W88-03146

FISCAL YEAR 1984 PROGRAM REPORT (D.C. WATER RESOURCES RESEARCH CENTER),
District of Columbia Univ., Washington. Water Resources Research Center.
M. H. Watt.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-168085/AS. Price codes: A03 in paper copy, A01 in microfiche. Report No. 68. September 1985. 27 p. Contract No. 14-08-0001-G-898. Project No. USGS G898-01.

Descriptors: *Hydrology, *Urbanization, *Nonpoint sources, *Research, *Information transfer, *District of Columbia, Statistical methods, Water quality, Runoff, Seminars, Mathematical models, Biochemical oxygen demand.

This FY 84 Institute Final Program Report presents the completed and continuing projects that the D.C. Water Resources Center conducted between August 1, 1984 and September 30, 1985. These projects are: (1) 'Development of an Improved Test for the Determination of Biochemical Oxygen Demand' by B.T. DeCicco. (2) 'Chemical

Separation of Water Samples' by V.M. Varma, B.E. Adebona, D.M. Patel, and B. Fisher. (3) 'Modeling Water Quality Variables of the Potomac River at the Entrance of its Estuary' by V. Yevjevich and N.B. Harmancioglu. (4) 'Water Resources Publications Pertaining to the District of Columbia' by S.A. Beese and M.H. Watt. (5) 'Assessment of the Impact of Non-Point Source Pollutants on an Urban River' by M.H. Watt. Also, the activities of the Center included seminars, field trips, newsletters and technology transfer activities. (Watt-D.C. Water Resources Res. Ct.)
W88-03147

FISCAL YEAR 1984 ANNUAL CENTER PROGRAM REPORT (FLORIDA WATER RESOURCES RESEARCH CENTER),
Florida Univ., Gainesville. Water Resources Research Center.
J. P. Heaney.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-168077/AS. Price codes: A02 in paper copy, A01 in microfiche. November 1985. 16 p. Contract No. 14-08-0001-G899. Project No. USGS G899-01.

Descriptors: *Water Resources Institutes, *Florida, *Research projects, *Universities, *Education, Wetlands, Stormwater, Biological waste treatment, Model studies, Technology transfer, Water quantity, Water quality, Geohydrology.

The 1984 Annual Center Report for Florida contains synopses of the following studies which were supported by this program: (1) Biological Flocculation in Waste-grown Algal Cultures, by Ben Koopman, Department of Environmental Engineering, University of Florida; (2) Effects of Harvesting Cypress Swamps on Water Quality and Quantity, by Katherine Carter Ewel, Department of Forestry, University of Florida; (3) Geologic and Geophysical Characteristics of Fracture Zones in the Floridan Aquifer by Mark T. Stewart, Department of Geology, University of South Florida. Twelve reports were published in 1984. Runoff, the quarterly newsletter, was sent to more than 1100 readers including 130 faculty. A major research study on hazardous wastes is underway with support from the U.S. Air Force. Also, three additional research projects sponsored by the U.S. Environmental Protection Agency, Sea Grant, and the Southwest Florida Water Management District, are active. (Heaney-U. FL. WRRC)
W88-03148

FISCAL YEAR 1984 PROGRAM REPORT (IDAHO WATER RESOURCES RESEARCH INSTITUTE),
Idaho Univ., Moscow. Water Resources Research Inst.
G. L. Bloomsburg.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-170503/AS. Price codes: A03 in paper copy, A01 in microfiche. Annual Report, Moscow. December 1985. 30 p. Contract No. 14-08-0001-G903. Project No. USGS G903-01.

Descriptors: *Water Resources Institutes, *Information exchange, *Education, *Idaho, Administration, Information dissemination, Water quality, Research projects.

The research and information dissemination activities of the Idaho Water Resources Research Institute during the 1984 fiscal year are reported. Synopses are presented for the following research projects: Blue-Green Algae Toxicity in Black Lake, Kootenai County, Idaho; Analysis and Generation of Low-Flow Sequences on Idaho Streams Using Disaggregation Modeling; Impact of Recreation on Water Quality in the Middle Fork of the Salmon River and Evaluation of Potability for Recreation Users; Arsenic Speciation and Acid Water Production Associated with Mining in the Coeur d'Alene Mining District; Estimation of Aquifer Recharge from Precipitation on Non-Irrigated Lands; and, Determination of Aquifer Characteristics in the Northeast Portion of the Boise Geothermal System. Information dissemination and workshop activity of the Institute is also reported. (Idaho WRRI)
W88-03159

FISCAL YEAR 1984 PROGRAM REPORT (ILLINOIS WATER RESOURCES CENTER),
Illinois Univ. at Urbana-Champaign. Water Resources Center.
G. E. Stout.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-170495/AS. Price codes: A03 in paper copy, A01 in microfiche. Program Report G904-01. September 1985. 25 p, 3 fig. Contract No. 14-08-0001-G904. Project No. USGS G904-01.

Descriptors: *Water resources research, *Illinois, *Technology transfer, *Education, Grants, Information transfer.

The University of Illinois Water Resources Center was established in 1963 to 'encourage and coordinate university-wide planning and implementation of interdisciplinary programs for research and graduate education in water resources.' Since designation by the Department of the Interior as the 'institute' for Illinois, the center's activities have become statewide. This report describes research accomplishments and other activities of the center during fiscal year 1984. The center's fiscal year 1984 research program included a total of five projects, covering the areas of secondary circulation in rivers, aquatic habitats in relocated streams, flow needs of aquatic life in streams, groundwater quality, and efficient use of water for irrigation in Southern Illinois. A summary of each research project is presented. The projects dealing with groundwater quality and with aquatic habitats in relocated streams have been continued into FY '85. (Stout-U IL)
W88-03163

FISCAL YEAR 1985 PROGRAM REPORT (WATER RESOURCES RESEARCH INSTITUTE OF THE STATE OF NEW YORK).
Cornell Univ., Ithaca, NY. Center for Environmental Research.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-162368/AS. Price codes: A03 in paper copy, A01 in microfiche. Program Report G1034. August 1986. 26 p. Contract No. 14-08-0001-G1034. Project No. USGS G1034-01.

Descriptors: *New York, *Water Research Institutes, *Research, *Information transfer, *Training, Agricultural chemicals, Fate of pollutants, Groundwater contamination, Insecticides, Monitoring, Pesticides, Pesticide kinetics, Pesticide-plant-model, Simulation, Soil contamination.

The Institute's 1985 program focused on groundwater issues which are a high priority in New York State. The goals of the program were to support needed research, to strengthen Cooperative Extension's capability in meeting educational needs, and to assist agencies and other public groups concerned with groundwater problems. The principal research focus concerned pesticides, their threat to groundwater, and possible management options. Steenhuis evaluated the transport of pesticides to groundwater through macropores or so-called 'fingers'. These physical phenomena are likely to result in higher levels of pesticides reaching groundwater more quickly than predicted by conventional 'piston-flow' assumptions. Lemley developed and assessed a rapid laboratory technique for estimating the life of pesticides once they have reached groundwater. Shoemaker formulated a pesticide-pest-plant model by which the more effective controls of pests may be achieved while reducing the amounts of pesticide used. Through several Extension projects, a comprehensive set of educational materials and techniques were developed. These were tested and used in several local communities. In particular, a youth education kit was developed through a 4-H project. Finally, interdisciplinary dialogue was achieved through a weekly campus-wide Colloquium and Seminar Series. (Porter-Cornell U.)
W88-03166

FISCAL YEAR 1985 PROGRAM REPORT (VERMONT WATER RESOURCES RESEARCH CENTER),
Vermont Water Resources Research Center, Burlington.
J. C. Clausen.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-162343/AS. Price codes: A02 in paper copy, A01 in microfiche. Program Report G1048-01. November 1986. 18 p. Contract No. 14-08-0001-G1048. Project No. USGS G1048-01.

Descriptors: *Water Research Institutes, *Research, *Information transfer, *Training, *Vermont, Algae, Carrying capacity, Clarification, Contact beds, Eutrophication, Institutional constraints, Nutrient removal, Physical processes, Public opinion, Public policy, Resource allocation, Sampling, Sedimentation, Statistics, Solids separation, Wastewater facilities, Wastewater treatment, Water quality, Wetlands.

The high priority water resource problems and issues of Vermont such as wastewater disposal and lake and wetland resources are discussed. Five research projects and two information transfer activities were funded by the Vermont Water Resources Research Center. Two research projects focused on wastewater treatment using attached microbes (periphyton) and investigations of the variability in sludge settling. Two projects addressed lake and wetland resources. One of these efforts established a Lake Champlain water quality data base and began examination of techniques for trend detection and the associated monitoring needs. The second project investigated public perceptions in the value of Vermont's wetlands. Another research project identified institutional devises for allocating wastewater capacity problems. The information transfer program co-sponsored a forest water quality and erosion control workshop and a groundwater workshop. Also, the use of a geographic information system was demonstrated on potential groundwater pollution sources, land suitable for wastewater application, analysis of hydrogeologic units for development of new groundwater supplies, and identification of potential radon contamination for one geologic formation. A pamphlet was prepared on household hazardous materials. (Clausen-U Vt)
W88-03167

FISCAL YEAR 1984 PROGRAM REPORT (HAWAII WATER RESOURCES RESEARCH CENTER),
Hawaii Univ., Honolulu. Water Resources Research Center.
L. S. Lau.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-157013/AS. Price codes: A03 in paper copy, A01 in microfiche. Program Report G-890-01. September 1985. 26 p, 3 ref. Contract No 14-08-0001-G902. Project No. USGS G902-01.

Descriptors: *Research, *Information transfer, *Training, *Hawaii, Fish, Streams, Aquatic habitats, Aquifers, Saline-freshwater interface, Adsorption, Groundwater pollution, Pesticide kinetics, Pesticide residues, Fumigants, Soil water disinfection, Water quality, Viruses, Bacteria, Coliforms, Surface water, Wastewater, Potable water, Wells, Standards, Water supply, Water treatment, Public health, Drinking water, Water use, Resource allocation, Chemical analysis.

Three events added to existing problems and issues, for water resources research in Hawaii: (1) the discovery of very low levels of pesticides in groundwater sources in the Pearl Harbor region that prompted the closure of several potable water wells; (2) the mandated state water code proposal, which was not passed by the state legislature and which proved to be most controversial during its preparation and in legislative deliberation; and (3) mandatory water conservation restrictions imposed for Oahu and parts of neighbor islands by County water utilities. A water research agenda has been developed, updated, and is being implemented. Seven research projects implemented the total pro-

gram. The problem of organic chemical contamination of groundwater is addressed by three projects: 'Desorption and Leachability of Residual DBCP and EDB in Soils and Saprolite,' 'Low Level Organic Pesticide Removal,' and 'Water Consumption: Assessing the Exposure to Chemical Contaminants in Hawaii's Community Subsurface Drinking Water Supply.' In-stream uses are addressed by two projects: 'Habitat Preferences of Hawaiian Stream Fishes,' and 'Water Supply Quality Enhancement by Selective Surface Water Intake Based on Turbidity.' The 'Dynamic Response of the Lower Boundary of a Basal Aquifer to Surface Disturbances--One Dimensional Analysis' project contributes to the understanding of overdraft of the groundwater aquifer and 'Evaluation of Chlorine Dioxide as a Disinfectant of bacteria and Viruses in Subsurface, Surface, and Wastewaters' contributes to the method of treatment to improve water and wastewater quality. As part of its information transfer activity, 'Activated Carbon Adsorption of Low Concentration Organic Pesticides in Water' was published with this grant and a seminar presented. A project-related seminar was 'Uses of Chlorine Dioxide for Water Treatment and Industrial Processes'. (Fujimura-HA U.)
W88-03169

FISCAL YEAR 1984 REPORT (KANSAS WATER RESOURCES RESEARCH INSTITUTE),
Kansas Water Resources Research Inst., Manhattan.
F. W. Smith.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-167681/AS. Price codes: A03 in paper copy, A01 in microfiche. Report G 907-01. September 1985. 39 p, 5 fig. Contract No. 14-08-0001-G-907. Project No. USGS G907-01.

Descriptors: *Kansas, *Technology transfer, *Research Act allotments, *Research facilities, *Grants, Irrigation, Agricultural runoff, Water use efficiency, Computer models, Water management, Reservoirs, Streamflow, Non-point pollution, Water shortage risk, Water conservation, Conservation practices, Water resources planning.

The Kansas Water Office (KWO) is the state's water planning agency. The Kansas Water Resources Research Institute works in consort with the KWO. The six projects reported in Grant No. 14-08-0001-G-907 were so developed. Two projects are concerned with planning - one with municipal water conservation and the other being concerned with urban flood management. Agricultural water conservation is the basis for one project. A functional model, designed to be used with data collected from a pumping plant performance test, was developed. Agricultural water conservation is the basis for one project. A functional model, designed to be used with data collected from a pumping plant performance test, was developed. Agricultural water conservation is a major component of the developing water plan. As pertains to irrigation, the two principal goals are: (1) reducing non-recoverable losses and (2) increasing efficiencies of water application. Interrelationships of water resource development, including the quality concept, and other concepts such as development, management and conservation have occurred. Two KWRRI projects, one dealing with nonpoint pollution and another with urban flood water management, were completed. Another recently added component of the Water Plan, Water-Related Wildlife and Recreation is in the planning stage. The director of KWRRI serves as chairperson for the Kansas Water Authority's planning effort. (Smith-Kansas St. U.)
W88-03175

FISCAL YEAR 1985 PROGRAM REPORT (NEW JERSEY WATER INSTITUTE).
Rutgers - The State Univ., New Brunswick, NJ. Div. of Water Resources.
Available from the National Technical Information Service, Springfield, VA 22161, as PB87-165932/AS. Price codes: A03 in paper copy, A01 in microfiche. Center for Coastal and Environmental Studies Program Report G1032-01. August 1986. 27 p, 1 tab, 7 ref. Contract No. 14-08-0001-G1032. Project No. USGS G1032-01.

Descriptors: *Water Research Institute, *Research, *Information transfer, *Training, *New Jersey, Groundwater, Groundwater contamination, Landfill, Leachate, Solid waste, Water pollution, Fish, Chlorinated hydrocarbons, Trace metals, Lakes, Bioaccumulation, Acid, Drainage, Acid rain, Bioindicators, Mollusks, Tidal marshes, Sedimentation, Water pollution control.

The 1985 New Jersey Water Institute program focused on the major issue currently facing the state: contamination of surface and groundwaters by organic and inorganic substances. Seven of the projects funded in 1985 were directed toward surface waters. Five studies addressed the physical, chemical and biological factors controlling the cycling of various trace elements in a variety of ecosystems, including a marsh, a swamp, several streams and rivers and two acid lakes. A sixth study investigated the effects of combinations of various volatile organic contaminants on fish. Another project determined the significance of sulfide-bearing deposits in the acidification of streams in northern New Jersey. A final project investigated the use of chloride as a tracer of the movement of leachate from landfills. Major information transfer activities included production of a Newsletter and an Annual Meeting. (McIntosh-Rutgers U.)
W88-03182

FISCAL YEAR 1985 PROGRAM REPORT (WYOMING WATER RESEARCH CENTER),
Wyoming Water Research Center, Laramie.
H. L. Bergman.
Available from the National Technical Information Service, Springfield, VA 22161, as PB87-165924/AS. Price codes: A03 in paper copy, A01 in microfiche. Program Report G-1054-01. August 1986. 36 p, 4 tab, 2 fig. Contract No. 14-08-0001-G1054. Project No. USGS G1054-01.

Descriptors: *Water Research Institute, *Research, *Information transfer, *Training, *Wyoming, Water quality, Organic contaminants, Groundwater, Surface water, Sediments, Eutrophication, Recreation, Economic benefits, Natural recharge, Stream discharges, Effluent streams.

Three research projects were funded under the FY 1985 program which covered topic areas in water quality problems in which organic contaminant transport between groundwater and surface waters was considered, recreational problems in which the effects of reservoir eutrophication on recreational activities and values is being assessed, and groundwater recharge through stream-aquifer interaction along fault zones. Information transfer was done principally through a symposium on Wyoming water problems, extension activities, mailings on available publications through a newsletter and participation at several meetings held by groups in the State of Wyoming on water issues. A field study on the movement of organic contaminants through groundwaters to surface streams created by a wood-treating facility and an oil refinery indicated that oily seeps occur into the surface stream and adversely affect the biological activity in the stream. Use of ambient toxicity tests were found to be sensitive enough to detect migration of contaminated groundwater into surface streams. A recreational based valuation method was developed and sample tested to estimate the effects of change in water quality due to eutrophication of a reservoir on recreational benefits and uses. The method used sampled recreationalists on direct and indirect contact at the reservoir site with a follow-up questionnaire. The sample data indicate a change in user recreational activities due to eutrophication. A field study is being conducted to investigate stream-aquifer interaction phenomena in fracture permeable Paleozoic rock outcrops. Using streamflow discharge measurements above and below the fracture permeable rock outcrop areas along with well level measurements, quantification of recharge due to streamflow during the entire year has shown that the groundwater system is being recharged directly from the stream at different rates during different times of the year. (Bergman-WY Water Res. Cr.)
W88-03183

FISCAL YEAR 1985 PROGRAM REPORT (OHIO WATER RESOURCES CENTER),
Ohio State Univ., Columbus. Water Resources Center.
R. C. Stiefel.
Available from the National Technical Information Service, Springfield, VA 22161, as PB87-165916/AS. Price codes: A04 in paper copy, A01 in microfiche. Program Report G1037-01. August 1986. 50 p, 8 ref. Contract No. 14-08-0001-G1037. Project No. USGS G1037-01.

Descriptors: *Water Research Institute, *Research, *Information transfer, *Training, *Ohio, Fluidized bed process, Biological wastewater treatment, Phenols, Adsorption, Cadmium assimilation, Sediment bacteria, Lake Erie, Water demands, Simulation analysis, Time series analysis, Municipal water, Safe yield, Risk-benefit analysis, Brine disposal, Water disposal wells.

Water is one of Ohio's most important natural resources, and the State has an adequate supply to meet its immediate needs. Most of Ohio's water problems are associated with water quality. Of primary concern are the sediments, nutrients and acids in the surface waters from urban, agricultural and mining areas, and the toxic and hazardous waters that threaten the ground and surface waters. The focus of the 1985 State Water Research Program was directed at some of these needs. One project examined the simultaneous adsorption and biodegradation that occurs in a three-phase fluidized bed that utilizes immobilized living microorganisms in an aerobic wastewater treatment process. Another project studied the specific mechanisms that certain bacteria have developed to resist inhibition caused by cadmium in the environment and to investigate the potential that these organisms have in the translocation of this highly toxic metal. A third project will develop a method to determine the impact that seasonal water usage has on the safe yield that can be developed from reservoirs used to supply municipal drinking water. The fourth project is an analysis of the risks and benefits that occur from disposing of oil and gas brines by injecting them in the annulus of producing oil and gas wells in the state. The Center's technology transfer program has produced a directory of the organizations in Ohio that have an important role in managing, protecting and conserving this invaluable natural resource. Training was provided through this program for twelve students enrolled in five disciplines at two universities in the State. (Stiefel-OH St. U., Water Res. Cr.)
W88-03184

FISCAL YEAR 1984 PROGRAM REPORT (IOWA STATE WATER RESOURCES RESEARCH INSTITUTE),
Iowa State Water Resources Research Inst., Ames.
E. Baumann.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-198108/AS. Price codes: A03 in paper copy, A01 in microfiche. Report No. G-906-01 1986. 40 p. Contract No. 14-08-0001-G-906. Project No. USGS G906-01.

Descriptors: *Water Research Act, *Iowa, Grants, Universities, Research and Development, Technology transfer, Education.

The Iowa State Water Resources Research Institute FY 1984 research program (University of Iowa and Iowa State University) was funded by the U.S. Department of the Interior, Geological Survey (allotment grant of $115,000) and by an Iowa Legislature appropriation ($135,000). The research program was centered in three areas critical to Iowa's natural resource program pertaining to water: Nitrogen and Pesticide transformation, Fate and Transport; Erosion; and Groundwater Management. Federal competitive funds were used to initiate two new projects relative to nitrogen/nitrate control in Iowa streams, to complete one study of erosion, and to complete one study and

continue another relative to groundwater management. Five studies were supported using state funding, all in the area of nitrogen/nitrate fertilizer control. A summary of each allotment project and source of the project progress or completion report is included in the Annual Report. (Baumann-Iowa St. U.)
W88-03185

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

ACTIVATED SLUDGE PROCESS USED IN COAL CONVERSION (1976-FEB 1984): CITATIONS FROM THE U.S. DEPARTMENT OF ENERGY (EDB) DATA BASE.
National Technical Information Service, Springfield, VA.
For primary bibliographic entry see Field 5D.
W88-02945

ANNOTATED BIBLIOGRAPHY OF THE GEOLOGY, HYDROLOGY, AND GEOTHERMAL RESOURCES OF THE JEMEZ MOUNTAINS AND VICINITY NORTH CENTRAL NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
C. G. Abeyta, and B. M. Delaney.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-83, 155 p, 2 ill.

Descriptors: *Groundwater, *Surface waters, *Bibliographies, *New Mexico, Water quality, Geology, Geochemistry, Geothermal studies, Geophysics, Modeling, Ecology, Jemez Mountains, Sandoval County, Los Alamos County, Rio Arriba County, Santa Fe County.

The Jemez Mountains volcanic complex, located in north-central New Mexico at the intersection of the Rio Grande rift and Jemez lineament, is a potential location for geothermal energy exploration. This bibliography lists selected papers pertaining to the geology, hydrology, geochemistry, geothermometry, geophysics, ecology, and geothermal and hydrologic modeling aspects of the Jemez region. The bibliography is composed of 795 citations with annotations and a subject and author index. (USGS)
W88-03068

SELECTED PUBLICATIONS ON THE WATER RESOURCES OF VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
N. R. Carrington.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 86-418, 1986. 34 p.

Descriptors: *Bibliographies, *Water resources, *Virginia, Publications.

This report presents a list of selected publications pertaining to the water resources in Virginia. The report includes a source-agency listing by publication type, which is arranged in alphabetical order by author. Information concerning the availability of the publications also is provided. (USGS)
W88-03135

WATER RESOURCES PUBLICATIONS PERTAINING TO THE DISTRICT OF COLUMBIA,
District of Columbia Univ., Washington. Water Resources Research Center.
S. H. Bessie.
Available from the National Technical Information Service, Springfield, VA 22161, as PB86-154572/AS. Price codes: A06 in paper copy, A01 in microfiche. Program Report WRRC No. 55. September 1985. 117 p. Contract No. 14-08-0001-G898. Project No. USGS G-898-22.

Descriptors: *Research, *Information transfer, *Bibliographies, *Publications, *District of Columbia, Urban hydrology, Water supply, Pollution.

The bibliography is a comprehensive list of water resources publications pertaining to the District of Columbia. It is intended to provide background information to researchers and managers. More than 800 titles are entered, with the bulk of them addressing mostly water quality and institutional issues. Each reference includes author, title, publisher, and number of pages when possible. The references are listed chronologically and indexed according to the classification scheme of the 'Abstracting and Indexing Guide of the Water Resources Scientific Information Center,' (DOI). (Watt-U. D.C., WRRC)
W88-03150

SOUTHERN CALIFORNIA ALLUVIAL BASINS REGIONAL AQUIFER-SYSTEMS ANALYSIS: A BIBLIOGRAPHY,
Geological Survey, San Diego, CA. Water Resources Div.
W. R. Moyle, P. Martin, K. Downing, A. L. Elliot, and D. E. Maltby.
Available from USGS, OFSS, Box 25425, Denver, CO 80225. USGS Open-File Report 85-695, 1986. 120 p, 2 fig, 2 tab, 3500 ref.

Descriptors: *Aquifer systems, *Bibliographies, *California, Geohydrology, Geology, Geophysics, Hydrology, Groundwater, Groundwater basins, Publications, Water resources, Alluvial basins, Regional Aquifer systems Analysis, Southern California.

A bibliography for the Southern California Alluvial Basins Regional Aquifer-Systems Analysis includes references for about 3,500 publications related to the geohydrology of the 75,000 sq-mi region, which encompasses all of southern California except the Central Valley, the Channel Islands and the Pacific Ocean floor off southern California, and parts of adjacent states and Mexico. The report indexes the publications in six geographic categories and induces a list of sources of publications. Because of the large number of references in the bibliography, a system was developed for computer storage and retrieval. References can be retrieved by geographic location, author, or geohydrologic discipline and subject. The computer system allows for updating and addition of references. (USGS)
W88-03395

QUALITATIVE AND QUANTITATIVE AQUATIC ALGAL DATA COMPILATION TO DETERMINE MACROTRENDS,
Arkansas Univ., Fayetteville. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 2H.
W88-03487

10F. Preparation Of Reviews

MICROBIOLOGICAL WATER QUALITY OF IMPOUNDMENTS: A LITERATURE REVIEW,
Texas Univ. at Dallas, Richardson. Center for Environmental Studies.
For primary bibliographic entry see Field 5A.
W88-02892

WHITE AMUR BIBLIOGRAPHY,
Florida Univ., Gainesville. Center for Aquatic Weeds.
For primary bibliographic entry see Field 4A.
W88-02919

STUDY AND INTERPRETATION OF THE CHEMICAL CHARACTERISTICS OF NATURAL WATER--3RD EDITION,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W88-03112

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Activated Sludge Process Used in Coal Conversion (1976-Feb 1984): Citations from the U.S. Department of Energy (EDB) Data Base.
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